New Brunswick
Tree & Shrub
Species of Concern

A Field Guide

Information Report M-X-212E

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P.O. Box 4000, Fredericton, New Brunswick E3B 5P7

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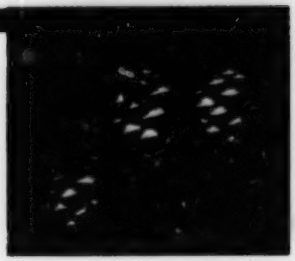

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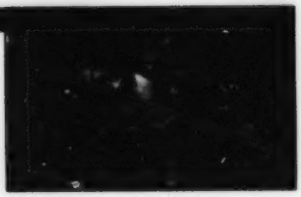
Introduction



Preface

The New Brunswick Gene Conservation Working Group was formed in 1997. The goal of the group is to develop gene conservation strategies for native New Brunswick trees and shrubs. The first step in achieving this goal was to identify which species require attention and may need a gene conservation strategy. This was done by assessing a number of factors for each species. For example, 1) is the species rare: 2) is there a serious threat from disease or insect pests that will impact this species; 3) is the preferred habitat of the species in great demand for other uses?

This guide does not list all native New Brunswick tree and shrub species; rather, it lists 26 species that may require gene conservation strategies. This guide is intended to help identify these species and to increase awareness of the importance of these natural resources.

The information used to evaluate whether a species requires conservation attention was taken from a wide variety of sources (forest inventory databases, historical information, and herbaria) and in consultation with woodlot owners, conservationists, and people from industry and provincial and federal forestry agencies. This list is not static; it will be constantly evolving, with various species being added and removed.

What is a gene?

A gene is an information-containing element that is made of deoxyribonucleic acids (DNA) and occupies a specific position on a chromosome. Genes are the hereditary units.

What is conservation?

Gene conservation is the preservation of the hereditary unit, a gene. This type of conservation is usually accomplished through the planned management of natural resources. This allows for the retention of natural balance, diversity and evolutionary chance in the environment.

What is a Species?

Species is often considered the basic unit of biological classification, falling below the classification of genus. For example, red spruce and black spruce are two different species in the spruce (*Picea*) genus.

What is a Population?

Population refers to a group of organisms of the same species living within a sufficiently restricted geographical area where any member can potentially mate with any other member.

What is the Range of a Species?

The range of the species is the geographical area (distribution) in which the species can be found. Typically range maps show where a species grows naturally. The exact boundary of a species range is often unknown.

What is a Hybrid?

For the purpose of this guide a hybrid is a plant resulting from a cross between parents that are not genetically the same. These parents can be different species, resulting in hybrid offspring. For example, black spruce pollen can fertilize red spruce ovules (precursors to seeds). The seed that is formed is a hybrid of the red and black spruce and this seed can germinate, producing a red x black spruce hybrid seedling. This red x black spruce hybrid has the genes of both species (parents). Hybridization is a term used to describe the process that produces hybrids.

What is Introgression?

One type of hybridization is introgressive hybridization, where the genes of one species are incorporated into the genes of another species. For example, if the range of two species, such as red and black spruce, overlap and fertile hybrids are produced, these hybrids will backcross (that is a cross of the hybrid to either red or black spruce) with the more abundant species in the range. This process will result in a population of individuals most of whom resemble the more abundant species (e.g., black spruce) but who also possess some characteristics (genes) of the other species (e.g., red spruce).

What is Rare?

Rare is a difficult term to define, because rarity cannot be quantified. It suggests that a plant species is uncommon, few in number or part of a small, scattered group. When referring to rarity, it is the scale that is important. For example, a species may be rare in one of its many populations or it may be rare in its geographical range. We are using rare in the context that a species is represented by a single population or that it may be few in number in its populations, geographical range, or in its habitat.

What is a Species of Concern?

In order to determine which tree and shrub species are at risk, we developed screening criteria. For a species to be considered at risk and in need of conservation measures, 'yes' had to be the answer for at least one of the following questions.

Criteria value	Questions to determine whether a species is at risk:
1	Is the species naturally rare in the area?
2	Is there no or an uncertain viable seed source?
3	Is there a serious threat from disease or insect pest or from changes in enviromental quality?
4	Is the range or frequency of the species substantially decreasing?
5	Is the preferred habitat of the species highly in demand for other uses?
6	Do certain harvesting practices prevent the regeneration of the species?
7	Is there high demand for the species for a special purpose?
8	Is the species threatened because of hybridization or introgression?

A rating system was then developed to prioritize those species that were considered at risk.

Rating value	Description
0	The species is considered to be in good shape with no apparent cause for concern.
1	The species may need attention, but our current knowledge is inadequate: **a)** insufficient data **b)** direct evidence of a potential problem **c)** indirect evidence of a potential problem.
2	The species requires attention at the level of silvicultural systems or forestry practices.
3	Specific gene conservation measures are required to ensure the integ-

Code	Scientific Name	English Name	French Name	CV[1]	RV[2]
TREE	*Abies balsamea*	Balsam fir	Sapin baumier		0
SMALL TREE or SHRUB	*Acer pensylvanicum*	Striped maple	Érable de Pennsylvanie		0
TREE	*Acer rubrum*	Red maple	Érable rouge		0
TREE	*Acer saccharinum*	Silver maple	Érable argenté		0
TREE	*Acer saccharum*	Sugar maple	Érable à sucre	4,6,7	2
SMALL TREE or SHRUB	*Acer spicatum*	Mountain maple	Érable à épis		0
SHRUB	*Alnus incana* ssp. *rugosa*	Speckled alder	Aulne rugueux		0
SHRUB	*Alnus serulata*	Hazel alder	Aulne blanc	1	1a
SHRUB	*Alnus viridis* ssp. *crispa*	Green alder	Aulne crispé		0
SMALL TREE or SHRUB	*Amelanchier laevis*	Smooth serviceberry	Amélanchier glabre		0
SMALL TREE or SHRUB	*Amelanchier sanguinea*	Roundleaf serviceberry	Amélanchier sanguin		0
TREE	*Betula alleghaniensis*	Yellow birch	Bouleau jaune		0
TREE	*Betula cordifolia*	Mountain paper birch	Bouleau à feuilles cordées		1a
	Betula glandulosum	Dwarf birch	Bouleau nain	1	1a
TREE	*Betula papyrifera*	White birch	Bouleau à papier		0
SMALL TREE	*Betula populifolia*	Gray birch	Bouleau gris		0
SMALL TREE or SHRUB	*Cephalanthus occidentalis*	Button-bush	Céphalanthe occidental	1	1a
SMALL TREE or SHRUB	*Cornus alternifolia*	Alternate-leaf dogwood	Cornouiller à feuilles alternes	3	1b
SHRUB	*Corylus cornuta*	Beaked hazel	Noisetier à long bec		0
SMALL TREE or SHRUB	*Crataegus flabellata*	Fanleaf hawthorn	Aubépine flabelliforme		0
SMALL TREE or SHRUB	*Crataegus succulenta*	Fleshy hawthorn	Aubépine succulente		0
TREE	*Fagus grandifolia*	American beech	Hêtre à grandes feuilles	3	3

[1] Criteria value
[2] Rating value

Code	Scientific Name	English Name	French Name	CV[1]	RV[2]
TREE	*Fraxinus americana*	White ash	Frêne blanc		2
TREE	*Fraxinus nigra*	Black ash	Frêne noir	4.7	3
TREE	*Fraxinus pennsylvanica*	Red ash	Frêne rouge		1a
SMALL TREE	*Fraxinus pennsylvanica* var. *austini*	Northern red ash	Frêne d'Austin		0
SHRUB	*Hamamelis virginiana*	Witch-hazel	Hamamélis de Virginie		1a
SMALL TREE or SHRUB	*Ilex verticillata*	Common winterberry	Houx verticillé		0
TREE	*Juglans cinerea*	Butternut	Noyer cendré	3,4,5	3
SHRUB	*Juniperus communis*	Common juniper	Genévrier commun		0
TREE	*Larix laricina*	Tamarack	Mélèze laricin		0
SMALL TREE or SHRUB	*Nemopanthus mucronatus*	Mountain-holly	Némopanthe mucroné		0
SMALL TREE	*Ostrya virginiana*	Ironwood	Ostryer de Virginie	4,6	2
TREE	*Picea glauca*	White spruce	Épinette blanche		0
TREE	*Picea mariana*	Black spruce	Épinette noire		0
TREE	*Picea rubens*	Red spruce	Épinette rouge	4,6,8	2
TREE	*Pinus banksiana*	Jack pine	Pin gris		0
TREE	*Pinus resinosa*	Red pine	Pin rouge	4	2
TREE	*Pinus strobus*	Eastern white pine	Pin blanc		0
TREE	*Populus balsamifera*	Balsam poplar	Peuplier baumier		0
TREE	*Populus grandidentata*	Largetooth aspen	Peuplier à grandes dents		0
TREE	*Populus tremuloides*	Trembling aspen	Peuplier faux-tremble		0

[1] Criteria value
[2] Rating value

Trees & Shrubs

and how their parts are described

This is a field guide about trees and shrubs. Trees are long-lived (perennial), tall, woody plants that have a single stem (trunk, bole, or mainstem) that carries a crown high above the ground. The stem is anchored in the ground by an extensive, below-ground root system, which also provides the tree with water and nutrients. A shrub, similarly, is a woody, perennial plant that has a crown and root system, but between these two parts there are several stems that arise near the base, and the whole plant is relatively short in stature.

In both trees and shrubs, the crown is made up of branches which bear side branches, or branchlets, which, in turn bear twigs or shoots. In fact, the whole above-ground part of a tree or shrub is produced by a succession of shoots that, with increasing age and thickening, become the twigs, branchlets, branches, and stems.

Each year, the crown extends by producing shoots. It is only on these new shoots that new leaves are produced. The leaves enable the plant to produce the food materials that it requires for its continued existence and growth. Some of the shoots produce reproductive structures (flowers, inflorescences, and fruits with seeds, or pollen cones, seed cones, and seeds).

Shoots may extend in one of three ways: (1) entirely from a miniature preformed state from inside an overwintered (dormant) scaly bud; (2) from a miniature preformed segment from a bud, followed by extension of a neoformed segment; or (3) entirely by neoformed extension. Neoformed extension is when the shoot parts (the leaves and their stem internodes) are newly initiated and extend directly to maturity without undergoing a period of dormancy and, therefore, without involvement of a scaly bud. Sometimes the features of preformed and neoformed structures on the same plant are different (as, for example, are the preformed and neoformed leaves produced by a long shoot of the sugar maple tree).

As a shoot ages through the growing season, its axis becomes woody, its surface features or color may change, buds may form in certain locations along its length, and its leaves may die and fall off, leaving scars where they were attached. At such a stage, the shoot is generally called a twig.

Features of leaves, shoots, twigs, buds, leaf scars, flowers, inflorescences (flower clusters), fruits, pollen cones, seed cones, seeds, and bark are useful for identifying species. Description of these items constitutes the morphology of the species. Coupled with morphology, the general form of the whole plant and the kind of habitat in which it usually grows aid in species recognition.

Nomenclature refers to the scientific names given to plants. Botanists mostly use the fine features of flowers or cones to classify species into genera, and genera into families. The scientific names given to plants reflect the genus (the first part of the name) to which the species (the second part of the name) belongs. These two parts of the name are in Latin, and are italicized in type. The last part of the name, which need only be stated at the first mention of the species in a piece of writing, is the name (often abbreviated in standard form) of the person or sometimes group of people who first named and described the particular plant. Thus, *Acer saccharum* Marsh. is the species called *saccharum* (meaning sweet or sugary) by Marsh. (Humphrey Marshall, an American botanist and dendrologist), who placed it in the genus called *Acer*. The value of scientific names is that they are exact and universal, and their usage is governed by an International Code of Botanical Nomenclature. In contrast, common or vernacular names can be confusing. For example, in this guide, *Acer saccharum* is given the common name "sugar maple", but the same species is sometimes called hard maple, rock maple, or érable à sucre.

The fine features of flowers or cones may be observed only in certain years and then only at certain times of the year and, of course, only on plants developed enough to carry them—and often, they are carried near the tree tops! Thus, they are thus relatively poor features for practical field identification, though some of their more easily discerned characteristics are included here.

The principal ways in which the species' features are described in this work are given in the following sections.

Leaves

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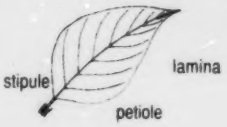
Deciduous leaves are borne for only one growing season. At the end of that season, they senesce, usually change color, die, and fall.

Evergreen leaves remain green and functional at least into the second growing season, and often longer. Ultimately they die and fall. This sometimes occurs alone, sometimes with the shoot on which they were borne (as in pines), and sometimes with multiple sprays of shoots (as in eastern white-cedar).

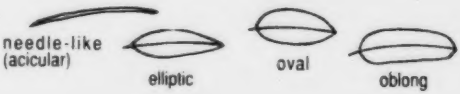
Simple leaves consist of a lamina (leaf blade), petiole (leaf stalk), and frequently a pair of stipules, one stipule on either side of the base of the petiole.



Pinnately compound leaves have the laminal part of the leaf divided into leaflets (pinnae) borne along a central stalk, or rachis, that extends from the tip of the petiole. The leaflets may themselves be stalked (have petiolules). The number of leaflets is often useful identification.

Leaf or leaflet shapes describe the overall outline of the structure. Shapes range from those broadest below the middle

to those broadest about the middle and mostly symmetrical end to end



to those broadest above the middle

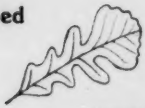
The shapes of the leaf or leaflet **bases** and **tips (apices)** also vary, but are defined in the text, as necessary.

Leaf margins may be lobed, variously toothed (described as necessary in the text), wavy, or smooth. Lobes are major bulges into which major veins extend. They are separated by indentations called sinuses or clefts.

Leaves may be **palmately lobed**

palmately lobed leaf—sugar maple

or **pinnately lobed**



pinnately lobed leaf—bur oak

Leaf & Lateral Bud Arrangement

Leaves are arranged along the shoot in one of four ways:

1. **Opposite arrangement**, in pairs:

Button-bush *Eastern white cedar*

2. **Whorled arrangement**, in threes or fours:

Button-bush

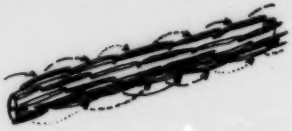
3. **Alternate arrangement**, in a single spiral that places leaves in

(A) two ranks, or rows along the shoot
(B) three ranks
(C) more than three ranks

End view of three arrangements of alternately placed leaves (leaves in 2, 3, and 5 ranks)

Side view of three arrangements of alternately placed leaves (leaves in 2, 3, and 5 ranks)

4. **Multiple-spiral arrangement**, as in conifers:

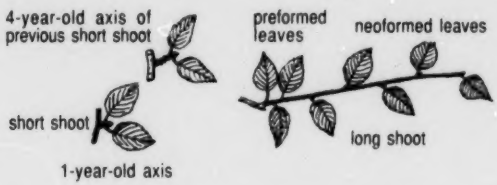


Leaves in multiple spirals, i.e., red spruce

Leaf arrangement determines the arrangement of leaf scars (when the leaves fall off) and lateral buds. Such buds form in the axils of leaves, that is in the angles between the leaves and the shoot; they are located just forward of the leaves or sometimes beneath them, or partially hidden by the bases of the petioles of the leaves.

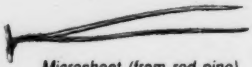
Kinds of Shoots

In all species there are some shoots that are longer than others. This is relative to where the shoot is located down the crown or inward on a branch. Some species, however, have shoots that can be developmentally distinguished from each other and designated as "**short shoots**" or "**long shoots.**"



In such cases, the short shoots are entirely preformed, extend only a millimeter or two (birches), or just a few centimeters (maples, ashes), and bear few leaves, which obviously must be borne close together. Short shoots are distinctive features of birches, usually having two leaves, a terminal bud, and sometimes a female catkin. In maples and ashes, short shoots usually bear one pair of leaves. Because they produce terminal buds with preformed short-shoot content, short shoots usually grow on short shoots, and so axes of several successive short shoots are produced. These species also produce long shoots that are partially preformed and partially neoformed. The leaves on the neoformed portions at the distal ends of the long shoots are spread out more than are the preformed leaves at the base. The neoformed leaves also frequently have a different morphology.

In contrast, the pines bear all their leaves (after the early seedling stage) on a special kind of short shoot, called a **microshoot**.



Microshoot (from red pine)

Normally, a microshoot grows marginally just once, bears leaves in numbers typical of the species (two in red pine), and lasts for a few years before the whole shoot, with its leaves, dies and drops from the tree. The microshoots are borne along long shoots in multiple spirals, in axils of scales that fall quite quickly.

Shoot-tip Abortion and Pseudoterminal Buds

In several species, as shoots are actively elongating and expanding their successive leaves, the developing tip of the shoot is, for some unknown reason, cut off from the older tissues below and abscised. This phenomenon is known as **shoot-tip abortion**. As a result, a lateral bud develops in the axil of the last leaf left on the shoot, and this becomes the new end of the shoot. When the end leaf falls in the autumn, its leaf scar is left at the base of the end bud, and the bud tends to arch over the tiny "twig" scar on its other side. This bud is usually called a **pseudoterminal (or false-terminal) bud**.

pseudoterminal bud (basswood)

Flowers, Flower Clusters, & Fruits

Flowers are the means by which the broad-leaved species of trees and shrubs produce seed, and hence reproduce sexually. In this guide, where gender is not specifically stated in relation to flowers, either the flowers concerned are "perfect" (having both male and female parts in the same flower) or flowers of each gender occur in the same flower cluster (inflorescence). Fruits develop from the female parts of these flowers, usually following successful pollination. Seeds develop inside the fruits. In other cases, male and female flowers, or male and female catkins, are mentioned. In these cases, it is only from the female structures that fruits and seeds can develop. **Catkins**, sometimes termed aments, are unisexual flower clusters (inflorescences) in which the many flowers are borne, associated with bracts, spirally along a central axis, or rachis. **Bracts** are small leaves or scales from the axil of which a flower or floral axis arises. Catkins are most commonly pendant (hanging down), but in some species, they (or those of one gender) are erect, at least in the earlier stages of their development. Male catkins fall from the twigs soon after their flowers have shed their pollen.

Catkin

Many fruits develop along the female catkins. In some species (*e.g.*, black willow), the fruits split open later in the season to release their seeds; in other species (*e.g.*, hazel alder and the birches), the fruits themselves are shed, carrying contained within them their seeds.

Inflorescences other than catkins and the racemes of black cherry are described in general terms in this work, rather than by their specific botanical names. **Racemes** are rather like catkins, but instead of being unisexual, they carry bisexual flowers on short flower stalks (pedicels) along a central, often hanging, rachis.

Racemes

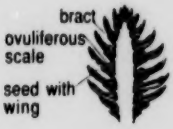
The fruits mentioned in this work are of many different types. There are the capsules of black willow and witch-hazel, that split open to release their seeds; the single-seeded nutlets of hazel alder, the birches, and button-bush; the single-seeded nuts of ironwood, beech, and bur oak (an acorn is a nut); the single-seeded samaras of the ashes, and the two-seeded double samaras of sugar maple; the single-seeded nut-like to drupe-like fruits of basswood and butternut (these fruits have characteristics of both nuts and drupes, but they really fit neither botanical classification); and the single-seeded drupes of alternate-leaf dogwood, black cherry, Canada plum, and squashberry. Only in the case of the capsules are pure seeds released into the environment. In all other cases, the seeds are covered by at least a part of the fruit, right up until the time that they germinate.

Pollen Cones & Seed Cones

The pollen cones produced by each of the coniferous species consist of a series of pollen sacs borne along a central axis. The axis extends and the swelling pollen sacs are carried outwards, the sacs split open, and the pollen is released into the air. This happens early in the spring before new shoots expand. The shriveled, spent pollen cones drop away or are gradually lost.

pollen sac

In all the coniferous species included here, except Canada yew, the seed cones have a series of ovules, carried on ovuliferous scales borne in bract axils along a central axis. The ovules are exposed to the air when the ovuliferous scales are spread apart in the small, receptive cone. Thus, pollen in the air can reach the ovules, or get reasonably close to them. As the cones grow, their ovuliferous scales close together, thus sealing the cones, which go on to complete their growth and mature. During this time, pollinated and fertilized ovules develop into seeds. Seeds are shed from mature cones when their scales once again spread apart. The seeds are terminally winged in red spruce, red pine, and eastern hemlock, and laterally winged in eastern white cedar.



In Canada yew, the seed cone is extremely modified. It has only one ovule. The tip of this ovule pushes out from the bud scales within which it has developed. From this tip, a drop of fluid exudes, and pollen landing on this drop is drawn into the ovule to effect fertilization. The ovule develops into a hard-coated seed. As this happens, the tissues on which the seed sits swell up around the seed and form a fleshy covering, which remains open at the top. This is the fleshy **aril** that changes from green to red as it matures.

aril

Bark & Wood

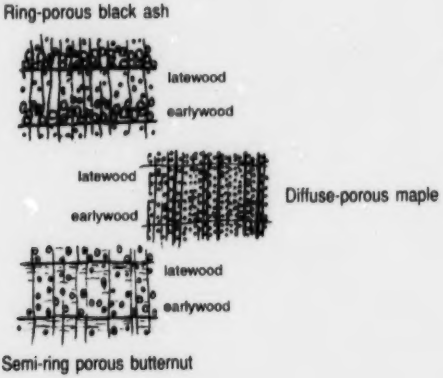
Bark forms around the branches and stems of woody plants. The bark of some species takes on distinctive characteristics that can be helpful for identification. These characteristics are described briefly for each species, but what may be seen depends to a large extent on the particular surroundings of the plant. For example, lichens growing on the bark can mask features and color, and make use of bark features difficult.

Wood is produced during each annual growing season inside the stems. In the New Brunswick environment, there is a distinct spring when growing conditions for wood production are good. Conditions gradually become less and less satisfactory for wood production as the summer advances and, as autumn sets in, wood production stops. The effects of this annual cycle show in the wood. The position where wood production slowed and stopped in one year and then started with a flourish in the next shows as a ring when the stem is cut across. The earlywood of the year is less compact than the latewood of the year.

In conifer woods, this shows as a difference in the size and wall thickness of individual cells of the wood. Cells are larger with thinner walls in earlywood. Thus, earlywood is less dense than latewood.

In the broad-leaved species, the largest cells show in cross section as relatively large pores in the wood, which, otherwise, is made up of many, densely packed, smaller cells. The distribution of the pores through the annual ring of wood varies in different species.

Wood is described as **ring porous** when most of the pores occur in the earlywood, **diffuse porous** when the pores are scattered evenly throughout the annual ring, and **semi-ring porous** when the pores, although scattered throughout the annual ring, are somewhat larger and more numerous in the earlywood than they are in the rest of the ring.



Species of Concern

Acer saccharum Marsh.

Sugar maple

Also known as: hard maple, rock maple.

Palmately lobed and palmately veined preformed leaf

Habitat

Sugar maple is typically found on hillsides and hilltop situations where soils are well drained and reasonably fertile. It often grows in mixture with beech and yellow birch. As it is very shade tolerant, it may be found in the understorey as well as the overstorey.

Form

Forest-grown sugar maple tree, adjacent trees cut

Sugar maple can grow up to 27 m in height, with stem diameters up to 70 cm. The crowns of older trees are generally rounded in outline and occupy 30–40% of the tree height in a stand. In open situations, the broadly oval crowns may reach nearly to the ground.

Morphology

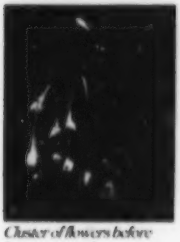
The **leaves** are deciduous, simple, and borne in pairs. Each is 10–25 cm long, with a petiole about as long as the palmately five-lobed lamina. The sinuses between the lobes are rounded and the lobe margins are smooth. The outer three lobes tend to be parallel sided below their two round-pointed side teeth from which the margins extend in a smooth concave manner to the longer, round-pointed lobe ending.

The shoots (twigs) are either fully preformed **short shoots** (usually with one or two pairs of leaves) or preformed (or partially preformed and partially neoformed) **long shoots** with more than two pairs of leaves. On the long shoots, the neoformed leaves near the shoots' ends tend to have longer and narrower lobes than do the preformed leaves on short shoots or at the bases of long shoots.

Twig showing the pointed terminal and lateral paired buds

Sharp-pointed **buds** with overlapping brown scales develop in each leaf axil, while a larger, sharp-pointed terminal bud forms at each shoot end. When the leaves fall, a V-shaped leaf scar is left below each lateral bud. **Twig** surfaces are smooth and brown and slightly mottled by small, pale brown lenticels.

The greenish-yellow **flowers** are each carried in hanging clusters on a long, limp stalk, emerging just before the leaves expand. Male and female flowers are separate in each cluster. The male flowers fall after shedding their pollen, while the female ones go on to form the fruits. Each **fruit** is a double samara—it has two almost round **seed pockets**, the coverings of which extend into flattened wings carried almost parallel to each other. Quite often, only one of the seed pockets carries a seed.



Cluster of flowers before leaves expand

The **bark** is smooth and grey on young trees. Later, it becomes deeply furrowed with scaly brownish-grey ridges.

Bark and stem, 38cm diameter

Notes

Sugar maple produces a heavy, hard, diffuse-porous wood, often called hard maple or rock maple, that is used in furniture, flooring, and specialty goods such as bowling pins and cutting boards. Sometimes flecks or flares occur in the wood, making it suitable for use in "bird's-eye maple" or "fiddleback" products. Rising sap is often tapped in the spring and boiled down for maple syrup and other maple-sugar products.

The so-called "maple dieback" has affected trees since the 1980s. It is suspected that this has been brought on by environmental changes, such as the increasing incidence of acid deposition in precipitation.

Double samaras with their wings almost parallel

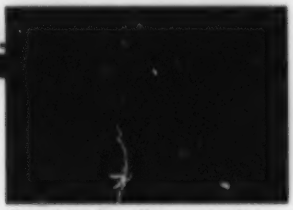
Sugar maple produces vigorous stump sprouts from latent buds in the bark around a cut stump. There is evidence that many single-stemmed trees originated from a coalescence of several stump sprouts from earlier cutting operations.

Sugar maple can be confused with Norway maple (*Acer platanoides* L.) because their leaves are superficially similar. However, the leaves of Norway maple mostly have seven lobes, the lobe tips and other teeth are longer and more finely pointed than those of sugar maple, and the sap that emerges from the base of the petiole when a leaf is removed is milky, not clear. Also, the buds are plump and rounded, not pointed, the twigs are seldom brown, the flowers are borne in multibranched, outwardly growing, strong clusters, and the fruits are much larger, with wide wings carried almost at 180° to each other.

Alnus serrulata (Ait.) Willd.

Hazel alder

Also known as: common alder, tag alder.



Expanded preformed leaves on two shoots and expanding preformed leaf on one shoot (right), and developing fruiting catkins at far right

Habitat

Hazel alder occurs in scattered, open locations along lake shores and associated somewhat swampy areas, including roadside ditches.

Form

Hazel alder is a spreading to upward-growing, multistemmed shrub, with one or more stems, occasionally having a somewhat tree-like appearance. It grows to heights of up to 5 m. Most stems are up to 5 cm in diameter, but the more tree-like ones may reach up to 12 cm in diameter. Branches tend to arch outward from the stems.

Shrub in bloom, about 4 m tall

Morphology

The **leaves** are deciduous, simple, and borne alternately (in a single spiral that distributes leaves in three ranks). Each leaf is 4–8 cm long, obovate to obovate-elliptic (broadest slightly above the middle), broadly wedge shaped to rounded at the base, tapered to an abruptly pointed tip, and finely and mostly evenly small toothed (serrulate) around the margin. Young leaves are slightly sticky; in older leaves, cross veins between the secondary veins are weakly developed and almost ladder like in appearance.

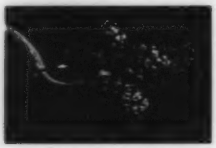
The **twigs** are greyish brown with surfaces marked by a few paler lenticels. The **buds** are stalked, obovoid (broadest above the middle and rounded at the tip) with two or three, brown scales of equal length. Each bud is borne above a projecting, roundly triangular **leaf scar** with three vein scars. The **pith** of the twig is triangular in cross section.

Leaf showing the serrulate (finely toothed) margin

Catkins at blooming stage: female (above) with upward-curving stigmas; male (below) extended and pendent

Both the **male** and **female catkins** are preformed and fully visible in unexpanded form over winter. The small female catkins are borne in clusters of two to four, carried on short branches, some of which are angled upwards away from the supporting twig's direction of

growth. The larger (longer) male catkins are borne in clusters of two to five, but these are on branches that are angled abruptly away, and mostly downward, from the supporting shoot's direction of growth. In the blooming period, the male catkins extend to 3–5 cm, are mottled whitish to yellowish green and brown (with brown anthers), and hang loosely to shed pollen. At this time, their placement below the female ones is distinctive. After the spent male catkins fall from the branches, the female ones go on to form **cone-like fruiting structures**, 8–14 mm long, made up of broadly tipped, thick, reddish-brown, woody bracts that, when they spread apart in the fall or winter, release small fruits with residual wings, each of which contains a single seed.



Fruiting catkins after winter

The **bark** of branches and stems is smooth, pale grey, and marked with similarly colored lenticels that are difficult to discern.

Bark of principal stem, 6 cm diameter

Notes

The above description is taken from specimens found in southwestern Nova Scotia.

Hazel alder is similar in general appearance to speckled alder (*Alnus rugosa* (DuRoi) Spreng.), but the details in the description provide several means to distinguish them. The name, speckled alder, comes from the speckled nature of its bark on branches and stems. The whitish, linear lenticels show distinctly against the greenish brown to blackish grey of the bark.

Differences occur in other features. The leaves of speckled alder are ovate to elliptical and thus broadest below or at the middle, and their margins are doubly and somewhat unevenly toothed, and wavy or slightly lobed. The cross veins between the secondary veins are strongly expressed and distinctly ladder like, especially when viewed from the underside. The short stems carrying the clusters of male and female catkins tend not to be angled away from the direction of growth of the supporting twig, so the two kinds of clusters are not widely separated, and particularly, the female ones are not carried upwards and away from the male ones. Also, in bloom, when the male catkins are extended, the speckled alder is less attractive as its male catkins are thicker, mostly dark brown with yellowish overtones, and not as delicately displayed.

Betula cordifolia Regel

Mountain paper birch

Catkins at blooming stage—female (left), males (right) both extended and pendant

Also known as: Mountain white birch, eastern paper birch.

Habitat

Mountain paper birch occurs on a wide range of moist, moderately drained soils, typically, but not exclusively, at higher elevations and on north-facing slopes. In southern New Brunswick, mountain paper birch is prominent close to the shores of the Bay of Fundy. It grows in mixture with a large number of other species but, as it is shade intolerant, it occupies positions in the upper canopy.

Form

Mountain paper birch grows to heights of up to 25 m and to stem diameters of up to 70 cm. The crown is broadly oval with its lower main branches tending to be more horizontal than upwardly inclined.

Fruiting catkin of the previous year, partially broken up

Morphology

The **leaves** are deciduous, simple, and arranged alternately along the long shoots and, although alternate, appear as pairs on most short shoots. Each leaf is 6–12 cm long, ovate, with a short tapered point, usually a cordate (roundly indented) base, and a doubly toothed margin. Upper surfaces of the leaves are dull green and dotted with tiny resin glands between the mostly straight, six to nine secondary veins per side; lower surfaces are paler. Leaves towards the ends of long shoots are neoformed and may have somewhat different characteristics from the preformed leaves at the bases of long shoots and on all short shoots.

Twigs are of two kinds, long and short. The **long twigs** (long shoots) become yellowish brown to dark brown by fall and are dotted with pale lenticels and warty resin glands. Their buds are all lateral buds (the end bud is a pseudoterminal bud) and each is ovoid, blunt pointed, brown, and has three visible overlapping bud scales. The **short shoots** extend only about a millimeter, usually bear two

leaves (and later, their leaf scars) and an ovoid terminal bud that has five to seven overlapping bud scales. Each short shoot commonly produces another short shoot, so on older branch segments, axes consisting of several successive short shoots are frequent.

Flowers are borne in catkins of two kinds. **Male catkins** are preformed before winter as elongated structures, 2–4 cm long, borne in outwardly spreading groups of two to four at the ends of long shoots. In the spring, as the new leaves begin to expand, the male catkins extend to lengths of up to 10 cm and hang limply. This spreads out their flowers, which then shed pollen into the air; subsequently the male catkins fall from the tree. **Female catkins** are also preformed but remain tiny over winter inside the terminal buds of short shoots, so are not visible until they extend in the spring. This extension, to 15–40 mm, occurs beyond the two expanding short-shoot leaves. The female catkins mostly are pendant during the pollination period. After that, they expand in length (to 3–5 cm) and thickness as their bracts and developing fruits grow (there are usually three fruits in the axil of each bract). The fruiting catkins change from green to brown as they ripen in the autumn, and then the bracts and fruits begin to fall from the catkins' hanging axes. Each flat **bract** is three lobed, the central lobe is longest and parallel sided, the side lobes are directed forwards, and all three are round tipped and hairy fringed. Each **fruit** is a hard, brown, ovoid nutlet, 2–4 mm long, with two flat, pale brown, broadly oval lateral wings and, at its tip, two prominent, hair-like, brown stigmas, 1.5–2 mm long (held over from the flower). Each fruit can contain one **seed**.

Bark of young stem, 5 cm diameter

The **bark** of young trees is shiny, reddish brown, with some wrinkling, and dotted with pale brown horizontal lenticels. Older bark is whitish, usually with a pinkish purple to bronze tinge, and is often somewhat ragged in appearance because small portions peel away readily, around the trunk, into thin sheets, which are copper colored on their inner surfaces. The bark is marked by many long, corky, horizontal lenticels.

Bark of old stem, 27 cm diameter

Fruit (left) and bract (right)

Notes

Mountain paper birch has only recently been fully recognized as a distinct species from white birch (*Betula papyrifera* Marsh.). Previously, the two species were treated as one. Generally, this was a problem because the species are similar ecologically and silviculturally. It is likely that the native peoples knew how to distinguish them because the bark of white birch tends to be shed in single, thick layers (not in multiple thin sheets), and is thus more serviceable for sheathing canoes and for fashioning utensils.

The details in the description should help to distinguish mountain paper birch from white birch (or grey birch [*Betula populifolia* Marsh.], with which it is known to hybridize). The leaves of white birch are more likely to be broadly wedge shaped, rounded, or straight across than cordate at the base: the reverse is true for mountain paper birch. Leaves of white birch and grey birch lack resin dots, and those of grey birch are shiny on their upper surfaces, and are long, taper pointed.

The twigs of white birch tend to be hairy at first, but lose most hair by fall. They have only occasional warty resin glands. Twigs of grey birch are slender and have many warty resin glands. Twigs of mountain paper birch are intermediate with respect to warty resin glands.

In winter, crown features help to distinguish the three species. Branches of white birch tend to have a mostly upward and outward orientation, giving a graceful appearance. Mountain paper birch branches have a flatter orientation. Those of grey birch are also horizontally oriented, but they are thin, and more numerous, and the crowns are relatively narrow. From close up, overwintering male catkins can help in identification. Grey birch has only one or rarely two at its twig tips, white birch usually two or three, and rarely one or four, and mountain paper birch, two, three, or quite often four. Those of grey birch are much smaller than those of the other two species.

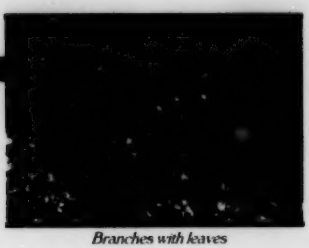
The fruiting catkins and their bracts and fruits are also useful means of species identification. The catkins of white and mountain paper birches are similar in length (3–5 cm), but those of the mountain paper birch are somewhat broader and more ragged because the bracts and the tips of the bracts are longer. Fruiting catkins of grey birch are only about 2 cm long and rather neatly compact. Bracts of grey birch are the smallest, while those of mountain paper birch are the largest. The mountain paper birch bracts have long tips with the two side lobes located at the front. The tip of a grey birch bract is short and pointed and its side lobes are outwardly and somewhat downwardly oriented. The bracts of white birch are intermediate between the others with a pointed tip and rounded side lobes of about equal length, the latter only slightly, if at all, forwardly oriented. The fruits of mountain paper birch are the largest and they have the most prominent stigma remnants at their tip.

Mountain paper birch wood is moderately hard, diffuse porous, and white or cream to pale brown; it has a uniform texture. It may be used in wooden ware, especially for turned goods such as dowels and spindles.

Mountain paper birch is sometimes affected by birch dieback which can result in tree death. The cause of birch dieback is thought to be a combination of several factors stressing the tree at one time. Mountain paper birch is susceptible to effects of acid deposition in precipitation; this has been observed in mountain paper birch located within the Fundy fog belt, where often persistent fogs carry considerable loads of acid and other material.

Betula glandulosa Michx.

Dwarf birch



Branches with leaves

Also known as: Tundra dwarf birch.

Habitat

Dwarf birch occurs on a variety of sites from dry sandy hillsides and rocky ridges to stream sides and bogs. It is a northern species, so in the south it occurs only at high elevations. In New Brunswick, it is known from near the summit of Big Bald Mountain, but might be present in other high areas.

Form

Dwarf birch is usually a short (up to 1 m tall), depressed or mat-forming, straggling shrub, but it may be a somewhat taller, more erect shrub. Its branches are frequently gnarled and twisted, and the crown is irregular.

Shrub in the fall, 0.5 m tall

Morphology

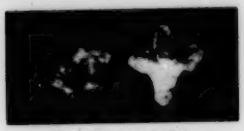
The **leaves** are deciduous, simple, and borne alternately along the usually few long shoots, and singly, or in twos or threes close together, on the many short shoots. Each leaf is oval, almost round to obovate, 5–25 mm long and nearly as broad, coarsely toothed around the margin, and leathery. The upper surface is dark green, shiny, hairless (or mostly so), and the under surface is only slightly paler. The leaves have three or four veins per side and may be a little sticky.

The **twigs** are hairless or slightly and finely hairy, and bear many warty, whitish, resin glands. The twigs may have a grey, waxy surface. The long shoots bear small, ovoid, brown, **lateral buds**, and the short shoots, bear small, ovoid, brown **terminal buds**.

The unisexual **flowers** are borne in male or female catkins. **Male catkins** are visible in unexpanded form at the ends of long shoots over winter. In spring they extend to lengths of 2–3 cm

Male catkin (extending left), erect female catkin (center right)

and hang limply to shed pollen before they drop from the twigs. **Female catkins** emerge beyond expanding leaves from terminal buds of short shoots. They are stalked, erect, and 10–15 mm long when their flowers are receptive to pollen. They extend another 10 mm as the fruits are developed. The bracts, which have three forward-pointing lobes and carry a resin gland on their backs, and the ripe fruits fall from the fruiting catkins beginning in the autumn. Each **fruit** is a small, broadly ovoid nutlet that has two narrow lateral wings, and two tiny, hair-like, stigma remnants at its tip. Each fruit can contain a single **seed**.



Fruit (left), bract (right)

The **bark** of older branches is dark brown, shiny, and speckled with scattered lenticels.

Notes

Dwarf birch may be confused with swamp birch (*Betula pumila* L.), which is outwardly similar. Bogs are the preferred habitat of swamp birch, but it may occur along the sides of lakes and streams. Its leaves are similar to those of dwarf birch, but are distinctly (not slightly) paler on the under surfaces and usually are dotted with tiny yellow glands. Yellowish (not whitish) warty resin glands also occur along its twigs. The bracts of its fruiting catkins have no resin glands, and the wings of its nutlets are half to almost as broad as the nutlet (not narrow).

Developing fruiting catkins and fully expanding leaves

Cephalanthus occidentalis L.

Button-bush

Fully expanded globular flower heads with stigmas sticking out from the center of each flower (center globular head) and miniature flowers (left and right of center globular flower)

Habitat

Button-bush is generally restricted to sites where the roots are covered by water in the spring. It occurs along rivers and streams, around lakes or ponds, or in marshy areas. It is rare in New Brunswick, with known locations around Grand Lake and along the Jemseg and St. Croix Rivers.

Form

Button-bush is a large, spreading shrub, with several stiff branches arising from the base: sometimes it is tree like. It grows to heights of up to 3 m, and is fairly regular in appearance.

Shrub at blooming stage: about 2 m tall

Morphology

The **leaves** are deciduous, simple, and borne in pairs oppositely, or in whorls of three, or sometimes four. Each leaf has a short, stout, grooved stalk (petiole), which has a somewhat persistent, triangular, sharp-pointed stipule on either side at its base. The leaf blade (lamina) is 5–15 cm long, thickish, ovate, elliptic or obovate, wedge shaped to rounded at the base, tapered to a point at the tip, and smooth to wavy around the margin. The upper surface is bright, dark green, and shiny, and the under surface is paler and may be softly hairy, especially along the veins.

The **twigs** are olive green at first, later turning brown, and have scattered pale lenticels. When leaves have fallen, the **leaf scars** at a node are connected by raised, stipule-scar lines, and the vein scars in each leaf scar are U-shaped. The **lateral buds** are embedded in the bark above the leaf scars, and thus are scarcely visible. The **pith** of the twig is light brown.

Expanded leaves

The tiny, creamy-white **flowers** occur at the ends of main shoots, or of stout stalks (peduncles) from axils of upper leaves, in dense, ball-like clusters (globular heads), 2–4 cm across. A swollen stigma occurs at the end of the style that sticks out from the center of each flower. Together, these look like tiny straight pins sticking out all over the surface of the flower cluster, giving a halo effect. The **fruits** are packed together in ball-like clusters (multiple fruits in globular heads). Individually, they are tiny, hard, dry brown nutlets, which broaden at their tips with remnants of the four-parted calyx of the flowers.

Multiple fruit clusters on globular heads

The **bark** of older stems is greyish brown to purplish grey. It may be smooth or somewhat furrowed.

Notes

Button-bush is a species of one of the largest families of flowering herbs, shrubs, and trees, the Rubiaceae. The family contains between 400 and 500 genera, and between 6000 and 7000 species. Among these, are the genera *Coffea* and *Cinchona*, the respective sources of coffee and quinine.

The foliage of button-bush is poisonous and unpalatable to livestock. However, the bark and roots, which may also be poisonous, have been used by North American natives for medicinal purposes.

Cornus alternifolia L.f.

Alternate-leaf dogwood

Flower clusters at blooming stage: note their upward orientation

Also known as: Pagoda dogwood, blue dogwood.

Habitat

Alternate-leaf dogwood grows in the understorey of open mixed woodland, along streams, in margins of forest areas, and in hedges, on fertile, reasonably well-drained soils, often on lower slopes. It tolerates some shade, but requires good light conditions to grow well.

Form

Alternate-leaf dogwood is a large, straggly shrub or small irregular tree that can reach heights of up to 8 m and stem diameters of up to 15 cm. The crown is irregular and often made up of attractive, horizontal tiers of branches that carry many short, upwardly growing shoots on which foliage tends to be clustered, but oriented outwards with upper leaf surfaces mostly flat. The pattern of shoot extension is unique for this region, in that the longer shoots arise in a neoformed manner as branches from the shorter segments. Dead branches may occur throughout the crown.

Small irregular-shaped tree, 5 m tall

Morphology

The **leaves** are deciduous, simple, dark green above and whitish below, and are borne alternately along the more vigorous shoots, and closer together and sometimes oppositely in pairs, or whorled, near the ends of shoots, especially shorter ones. Each leaf is 4–12 cm long, ovate and widest near the middle, tapered to a long-pointed tip, and to a rounded to wedge-shaped base supported by a petiole about half as long as the blade. The secondary veins curve outwards and forward to follow the smooth, wavy, leaf margin towards the leaf tip.

Expanding leaves below developing flower clusters at the bud stage

The **twigs** are shiny, greenish red, to purplish red or dark reddish brown, and angled dis-

Twigs with long sylleptic segments

tinctly where the neoformed longer segments diverge from the short segments. The **buds**, most of which are terminal buds, are small, pointed, with two or three purplish scales, the outer one appearing loose.

The cream to white **flowers** are borne in multibranched, rounded, but flat-topped, clusters at the tips of new leafy shoots. Because only some of the flowers in each cluster go on to form fruits, and the other ones drop off, the clusters of fruit are less dense, and the jointed reddish stems that support them show up more. The **fruits** are berry-like drupes, 8–10 mm across, and dark blue or bluish-black when ripe in late summer.

Ripe fruits in a pinkish-red-stemmed cluster

The **bark**, when young, is thin, dark olive green to reddish or purplish brown with thin, pale brown, mostly vertical fissures. With increasing age, the fissures deepen and broaden and become separate greyish-brown, flattish ridges.

Bark of a young stem, 2 cm in diameter

Notes

The wood of alternate-leaf dogwood is diffuse porous, heavy, and hard. It resists abrasion, and has no commercial value, but may find local use in wooden bearings and slides.

The other dogwood shrub species can be distinguished from the alternate-leaf dogwood by means of the opposite arrangement of their leaves and lateral buds, and opposite branching. The leaves of glossy blackthorn (*Rhamnus frangula* L.), a vigorously naturalizing and spreading European species, are somewhat similar to those of alternate-leaf dogwood. However, that species is readily identified by its greenish-white flowers and its fruits that change from green to black as they ripen, and are borne on short side stalks along many of its leafy branches.

Bark of old stem, 4 cm in diameter

Fagus grandifolia Ehrh.

American beech

Developing spiny fruiting husk and full-grown leaves

Habitat

Beech is a species that prefers richer, moist, but well-drained sites, mostly on hillsides or hilltops. It is very shade tolerant, and is frequently mixed with sugar maple and yellow birch.

Form

Beech is a tree that can grow up to 25 m in height (though it is often much shorter) and reach a stem diameter of up to 60 cm. In a stand, the crown is small and oval, but in the open, the crown is broadly rounded and quite deep. Sometimes beech stems are clumped, signifying earlier vegetative reproduction.

Morphology

Beech is probably the easiest tree to recognize: it has several distinctive features. The deciduous, simple **leaves** are borne alternately (or in a single spiral) along the shoots. Each leaf is 7–15 cm long, short-petioled, with an eliptical lamina that ends in a sharp point. The leaf margins have many small, outwardly pointing teeth, each one at the end of a distinctive, almost straight, secondary vein, and separated from the next tooth by a short segment of straight leaf margin. Sometimes, dead brown leaves are held on the trees over winter.

Twig showing the long, pointed buds carried at wide angles

The longer, light brown **twigs** tend to be slightly zigzagged with lateral buds carried at a wide angle at each twig bend. The **terminal bud** is 15–25 mm long, lance shaped, and sharp pointed. The **lateral buds** are similarly shaped but smaller; those near the base of the twig or on short twigs are tiny. Each lateral bud tends to be offset from the small semicircular **leaf scar** on the twig below it.

Male flowers are carried clustered at the ends of long, hairy, drooping stems that are borne in groups at the bases of new shoots, as the leaves are expanding. These stems and flowers drop off after the blooming period. The **female flowers** are borne in small groups on short stems in axils of new leaves further out along the new shoots. These later develop into **bristly husks** which open into four parts to allow

Male flowers clustered at ends of long stems from the base of a new leafy shoot

Two upward-oriented female flowers in the axil of a leaf, part way along a new leafy shoot

the two triangularly pyramidal **nuts** they enclose to be shed, when they are ripe in the fall. Each nut can contain a **seed**.

Open four-parted husk and two fruits (nuts)

The **bark** is thin, smooth, pale bluish grey, and often mottled with cankers. It tends to darken with age and to become slightly scaly.

Bark of a non-cankered stem, 2½ cm in diameter

Bark of a non-cankered stem, 60 cm in diameter

Notes

Beech wood is diffuse porous, heavy, and hard. It is used for flooring, furniture, containers, butcher blocks, and wooden ware.

The cankers, that are so common in southern New Brunswick, are produced by the tree in response to the introduced fungus called beech bark disease (*Nectria coccinea* var. *faginata*) which enters through tiny feeding wounds made by a small, yellowish, sap-sucking insect called the beech scale (*Cryptococcus fagisuga*). The fungus produces tiny clusters of bright red fruiting bodies around the bark cankers.

Cankered bark of a stem, 25 cm in diameter

The scale insect and the fungus were accidently introduced into North America at Halifax, Nova Scotia before 1900. The native American beech has no natural resistance to either, so "beech bark disease" and "beech scale" moved westward as a wave from Halifax. In 1961, they were found in the last uninfested county in New Brunswick (Madawaska) and now occur throughout eastern Canada to Quebec and into Ontario, and as far south as Virginia and west to Ohio.

Beech is unique among New Brunswick trees in that it can regenerate by producing new shoots from callus tissue (wound tissue) produced by the cambium around the freshly exposed surfaces of cut stumps. Such shoots occur in large numbers, but they are relatively weak, and it takes several years for a few stems to emerge and grow effectively. Beech also produces sucker shoots from surface roots of recently cut trees, but it is possible that these are also of wound-tissue origin.

Fraxinus americana L.

White ash

Pinnately compound leaf with seven petiolated (stalked) pinnae (leaflets)

Habitat

White ash occurs as scattered individuals, on richer, moist, but well-drained soils, in mixture with sugar maple, beech, yellow birch, basswood, and butternut, or with some conifers. It tolerates some shade when young, but needs good access to light later if it is to maintain its place in the stand.

Form

White ash trees may reach heights of up to 23 m and stem diameters of up to 70 cm. The stem is typically long and straight in stand conditions and it carries a high, narrow, pyramidal crown of upper ascending branches, and lower branches that arch outwards and then upwards at their tips. In open conditions, the crown is much deeper, and broadly pyramidal to rounded.

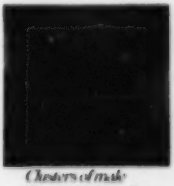
Medium sized tree in spring

Morphology

The **leaves** are deciduous, pinnately compound, 15–40 cm long, and borne in pairs, with each pair at right angles to the previous one. Each leaf has five, seven or nine leaflets, with seven being the most common number. The **leaflets** are stalked, 6–15 cm long, oval to lanceolate, with wavy or slightly toothed margins, and are usually hairless, as are the petiole and rachis. In the fall, white ash foliage frequently becomes purplish, and that makes the trees stand out from others. The leaflets fall separately, rather than whole leaves falling.

Twigs of three ashes: white ash (left), red ash (right), and black ash (center)

The **twigs** are stout, purplish to dark grey, somewhat shiny, with scattered lenticels that do not protrude from the hairless surface. The **buds** are dark brown to reddish brown, and closely downy. The **terminal bud** is blunt, dome shaped but somewhat four sided, with the uppermost pair of lateral buds touching it. The **lateral buds** are smaller, rounded to round pointed, and each is set in a V-shaped notch in the upper edge of a U-outlined **leaf scar** that carries a U-shaped line of tiny vein scars.

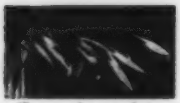


Clusters of male flowers at the pollen shedding stage

The **flowers** are borne from lateral buds in oppositely branched, extended

clusters, the male ones being more compact in bloom than the female ones. **Male** and **female flower clusters** occur on different trees, so it is only on female trees that the flowers go on to produce fruits. The 25- to 40-mm long **fruits** each have a sausage-shaped seed pocket, near the tip of which extends a flattened, elliptically rounded wing.

Female flower clusters shortly after blooming stage



Clusters of mature fruits—the wings start near the end

The **bark** is smooth and grey when young. As the bark ages, it becomes finely and evenly furrowed with thin, firm, somewhat rounded, light grey ridges that tend to intersect in diamond patterns.

Bark of a stem, 50 cm in diameter

Notes

The light brown, ring-porous wood of white ash is heavy, hard, strong, tough, and usually straight grained. It takes bending well. These features make it suitable for snow shoes, sporting goods, tool handles, and furniture, especially where strength is required.

There is no question that ash can be stressed by drought or site conditions, but one of the main factors affecting its continued health is the presence of ash rust (*Puccinia sparganioides*) whose alternate hosts are the *Spartina* ssp.—cordgrasses or marram grass—common in coastal salt and freshwater marshes. The rust may build up unnoticed on cordgrass in the vicinity and, in a favorable year, cause serious damage to nearby ash, especially white ash. Spores released from cordgrasses in marshes have been reported to infect ash trees up to 48 km away under favorable conditions. Severely infected ash trees may appear scorched and the infections of the twigs, petioles, and leaves can result in defoliation. Repeated severe infections can cause large branch mortality leading to the death of trees.

Morphological descriptions should be compared with those of the two other ash species, black ash and red ash, as some features are superficially similar. The only other species likely to be encountered with pinnately compound leaves borne oppositely in pairs are the introduced tree species, Manitoba maple (*Acer negundo* L.), and the two native elderberry shrubs (common elder, *Sambucus canadensis* L. and red-berried elder, *Sambucus pubens* Mich.). These species have other features that do not fit at all closely with those of the ash species.

Newly expanded leaves

Fraxinus nigra Marsh.

Black ash

New shoots at branch ends, and extended female flower clusters

Also known as: swamp ash, loop ash.

Habitat

Black ash is typical of swampy woodlands that have moving water and stream banks, in north, central, and western New Brunswick. It may be associated with species such as red maple, speckled alder, balsam poplar, eastern white cedar, and black spruce but, because it is shade intolerant, it grows only in relatively open situations.

Form

Black ash is a small tree that grows to heights of up to 18 m and to stem diameters of up to 40 cm. The crown is narrow and rather open, becoming rounded at the top, with ascending or arching and upturning branches.

Sinuous tree in summer

Morphology

The **leaves** are deciduous, pinnately compound, 20–45 cm long, and borne oppositely in pairs with each pair parallel to the previous one. Each leaf has seven, nine, or eleven leaflets, with nine being the most common number. The **leaflets** are stalkless, 10–16 cm long, long oval to broadly lanceolate, with finely and sharply toothed margins, and both surfaces hairless, except for distinct tufts of hair at the bases where the leaflets join the rachis. In the fall, the leaflets tend to shrivel as they turn brown, and then whole leaves are shed.

The **twigs** are stout, green with purple, raised **lenticels** when young, becoming pale greyish brown or tan with the lenticels still noticeably raised from the otherwise smooth hairless surfaces as small, pale, vertically elongated mounds. The **buds** are dark brown to black, or sometimes pale brown, and closely downy. The **terminal bud** is broadly flame shaped when viewed from one side, and more dome shaped if turned 90°, with the uppermost pair of lateral buds usually some distance below and separated from it by a portion of twig surface. The **lateral buds** are smaller and mostly rounded, each set above, or only slightly indented into the upper edge of, a longitudinally oval to shield-shaped **leaf scar** that carries almost a ring of tiny vein scars.

Twigs of three ashes: white ash (left), red ash (right), and black ash (center)

The **flowers** are borne from lateral buds in oppositely branched, extended clusters, the male ones being somewhat more compact in bloom than the female ones. **Male** and **female flower clusters** occur on different trees, so it is only on female trees that the flowers go on to produce fruits. The 25- to 40-mm long **fruits** each have a slightly swollen, broadly oval, basal seed pocket that tends to merge all around into a flattened, broadly elliptical, often somewhat twisted wing, that may be notched at its rounded tip.

Fruits forming on flower clusters of a female tree

Fruits—the seed pockets are scarcely distinct and the wings are twisted

The **bark** is grey and roughened with rounded, soft, corky ridges on young trees. On older trees, the bark is grey with near-vertical, narrow, scaly strips.

Bark of an older stem, 15 cm in diameter

Notes

The brown ring-porous wood of black ash is straight grained, tough, and flexible, but not as hard or strong as that of white ash. It takes bending well. It can be used for snow shoes, barrel hoops, canoe ribs, and woven basketware. For the latter, wet black ash wood is pounded to separate it into thin slats. The pounding causes the thin-walled, large vessel elements (pores) of the early wood of an annual ring to break, so the wood is separated almost into annual sheath widths.

A disease or decline of unknown nature has killed many black ash in at least the Fredericton area over the last 15 years. (See the Notes section for white ash for possible causes of the ash dieback.)

As indicated in the notes for white ash, the descriptions of the three native ash species should be compared for easy species recognition.

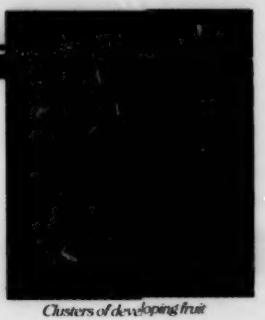
Corky bark of a young stem, 2.5 cm in diameter

Fraxinus pennsylvanica Marsh.

Red ash

Habitat

Red ash typically occurs along banks of larger rivers or along shores of larger lakes in the western half of New Brunswick. It is often associated with silver maple and various willows.



Clusters of developing fruit

Form

Red ash is a small to medium-sized tree that can grow to heights of up to 25 m and to stem diameters of up to 60 cm. In New Brunswick, however, at the northeastern extremity of its large range, it is usually no more than about 15 m tall and 45 cm in stem diameter. The crown is generally irregularly rounded to pyramidal, or the tree takes on a somewhat shrubby form.

Forest-grown tree

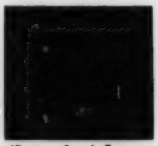
Morphology

The **leaves** are deciduous, pinnately compound, 20–40 cm long, and borne in pairs with each pair at right angles to the previous one. Each leaf has five, seven, or nine leaflets, but seven is by far the most common number. The **leaflets** are short stalked, 8–15 cm long, oval and taper pointed, with smooth to wavy margins that are toothed about the middle, and undersurfaces that are densely hairy. The short leaflet stalks, and the rachis and petiole of the leaf are all hairy. Leaflets tend to fall separately in the autumn.

Twigs of three ashes: white ash (left), red ash (right), and black ash (center)

The **twigs** are stout, reddish to greyish brown, and somewhat downy with short reddish hairs that are retained longest near the buds towards the ends of the twigs. The **buds** are reddish brown and closely downy. The **terminal bud** is pyramidal to rounded, with the uppermost pair of lateral buds touching it. The **lateral buds** are smaller, round to round pointed, and each is set above a shallow indentation in the upper edge of a half-rounded **leaf scar** that carries mostly scattered vein scars.

The **flowers** are borne from lateral buds in oppositely branched, hairy stemmed, extended clusters, the male ones being more compact in bloom than the female ones.



Cluster of male flowers

Clusters of female flowers after blooming stage

Male and **female flower clusters** occur on different trees, so it is only on female trees that the flowers go on to produce fruits. The 25- to 40-mm long **fruits** each have a sausage-shaped seed pocket, from which, at about half way along its length, a flattened, elliptically rounded or notch-tipped wing extends.

Fruits—wings start mid-way along the seed pockets

The **bark** is smooth and reddish grey to reddish brown when young. As the bark ages, it breaks into narrow, irregular, somewhat rounded, greyish-brown ridges that tend to intersect in irregular, diamond-shaped patterns. From a distance, in winter, the reddish hue of the younger branches is often apparent.

Reddish bark of a young stem, 4 cm in diameter

Bark of an older stem, 28 cm in diameter

Notes

Red ash wood is not generally distinguished from that of white ash, so it has similar uses. However, the relatively small size of red ash trees limits its use.

Red ash (usually its more western variety generally known as green ash) is often planted as an ornamental, or along avenues as a roadside species. Green ash is much less hairy in all its parts than is the native red ash.

As indicated in the notes for white ash, the descriptions of the three native ash species should be compared for easy species recognition.

Hamamelis virginiana L.

Witch-hazel

A leafy shoot in spring

Habitat

Witch-hazel occurs on moist, moderately to well-drained soils in the understorey of open woods, at forest edges, on slopes of ravines, and sometimes on gravelly lake shores.

Form

Witch-hazel is usually a large, spreading shrub with many crooked stems, but it can take the form of a small tree and reach heights of up to 6 m and stem diameters of up to 15 cm. The crown is irregularly rounded to outwardly arching.

Shrub with crooked stem in the understorey

Morphology

The **leaves** are deciduous, simple, short-petioled, and alternately arranged. Each leaf is 6–15 cm long, irregularly oval, rounded, or obovate, and often uneven sided with an asymmetrical base. The margins are wavy to coarsely toothed, especially above the middle and on the flanks towards the bluntly rounded, or short-pointed, tip. The five to seven secondary veins on each side are widely spaced, straight, and angled forward.

The **twigs** are yellowish brown, somewhat hairy at first, but mostly hairless by autumn. **Terminal buds** are up to 14 mm long, flattened and usually curved, with a dense coat of short, yellowish-brown hairs on the exposed surfaces of the first preformed leaves—there are no bud scales. The **lateral buds** are smaller, but similar, and sometimes two are set one above the other at a leaf scar. **Leaf scars** are slightly raised and oval to triangular, with three vein scars.

Twigs with unevenly spaced buds, and developing fruits (on side shoot from twig at right)

The **flowers** are usually borne in clusters of three in leaf axils, and they bloom from September to October. They each have four, 15- to 20-mm long, strap-shaped, twisted, bright yellow petals, which show up well among the leaves as they turn from green to yellow, or as the leaves are falling.

Clusters of flowers, each with four long yellow petals, September

Fruits develop slowly at the base of the flowers. Through the following summer, they become distinctive green, closely downy, broad capsules, indented into two protrusions at the tip and skirted below the middle by the enlarged, cup-shaped remnants of the flower's calyx. The 8- to12-mm long capsules turn yellowish green then pale brown in the autumn, and split open explosively to eject two shiny black **seeds** that may be projected several meters. Empty capsules remain on the branches for a further year or so.

Ripening, full-grown fruits (capsules), September

The young **bark** is smooth and light greenish brown. As the bark ages, it becomes slightly scaly, mottled, and greyish brown.

Bark of stem, 3 cm in diameter

Notes

A forked twig of European witch-hazel was the tool of choice for water diviners. This use may have given rise to the plant's name.

The bark, branches, and leaves yield a volatile oil, with a distinctive aroma, that is used in pharmaceuticals such as body rubs, skin lotions, and eyewashes.

The fall flowering provides an interesting feature for landscape and garden plantings. Thus, witch-hazel has use as an ornamental and some cultivars have been developed for that purpose.

Juglans cinerea L.

Butternut

Also known as: white walnut.

Expanding leaves of a new shoot, with male catkins below

Habitat

Butternut occurs in central, western, and southwestern New Brunswick, mostly on deep rich soils on lower slopes of valleys of the larger rivers. It grows scattered among other hardwoods, sometimes in small groups, but always with its crown exposed to light because it does not tolerate shade.

Form

Butternut is a relatively short-lived tree (60 to 70 years) with a broad spreading, irregularly rounded crown. It commonly reaches heights of 13–20 m and stem diameters of 30–60 cm. The thick twigs and sparse, uneven branching at the crown's periphery, help to distinguish this species in winter.

Medium-sized tree in the summer

Crown of small-sized tree in winter

Morphology

The large **leaves** are deciduous and alternately arranged. They are 20–50 cm long, pinnately compound, with 11–17 finely toothed, broadly lanceolate to oval **leaflets** that have closely hairy undersides. The lateral leaflets are arranged more or less opposite to one another along a glandularly hairy rachis that extends from a relatively short petiole that has a broadened base.

The stout, strong, greenish-grey somewhat hairy new **twigs** carry large (12–18 mm long), closely downy **terminal buds**, and much smaller **lateral buds** (often two, one above the other) above each distinctive leaf scar. The **leaf scars** are large, broadly triangular, but with rounded edges. They have three groups of vein scars, and a distinct hairy band, or lip, along the upper margin. The **pith** of a new twig is cinnamon brown and, as it ages (as in a 2-year-old twig), it becomes chambered (so, if cut lengthwise, it appears ladder like).

Twigs, buds, lateral buds often one above another, at one leaf scar, shield-shaped leaf scars, and chambered pith exposed on older portion (bottom left)

An expanded male catkin

The **male flowers** are produced in thick, green catkins 6–14 cm long, that arch out and down from lateral buds below the shoots and leaves beginning to grow out from the terminal buds above. The **female flowers** are much less conspicuous, occurring in small groups on short stems arising in axils of new leaves some distance along the stronger of the new shoots. The distinctive **fruits** develop from the female flowers as the season progresses.

Female flowers clustered along a stem in the axil of a new leaf

By early fall they are 4–6 cm long, ovoid, green, stickily hairy structures. Inside the husk is the nut with its hard, thick, woody, convoluted shell and, inside the shell, the seed—which is the edible "nut." Handling the fruits turns skin yellow.

Developing fruit in late summer

The **bark** is smooth and light brownish grey when young; it becomes deeply and openly furrowed with intersecting flat-topped ridges when older, but remains brownish grey.

Bark of stem, 18 cm in diameter

Notes

Butternut wood is semi ring porous, pale reddish brown, fairly soft and weak, but valued for veneer, furniture, cabinet work, and interior trim. However, it is seldom available because large trees are scarce. The nuts are an interesting food source, but the primary beneficiaries are squirrels. A useful yellow dye can be extracted from the fruit husks.

Butternut is increasingly threatened by butternut canker, a fatal disease caused by a fungus, *Sirococcus clavigignenti-juglandacearum*. This fungus induces multiple cankers at the base of the trunk and branches, which coalesce and girdle the tree, resulting in partial to complete death. To date, no control for this disease exists.

Ostrya virginiana (Mill.) K. Koch.

Ironwood

Also known as: Hop-hornbeam.

Developing fruiting catkin and a full-grown leaf

Habitat

Ironwood occurs naturally in the southern half of New Brunswick. It usually grows as scattered individuals among sugar maple, beech, yellow birch, and white ash on rich, well-drained sites, and often in the understorey, as it is a relatively small, very shade-tolerant species.

Form

Ironwood rarely grows taller than 13 m or to stem diameters greater than 30 cm. It usually produces an upright stem that is visible almost to the top of the crown. The crown is rounded and the branches may spread widely, especially when grown in the open.

Mature tree

Morphology

The **leaves** are deciduous, simple, alternately arranged, and tend to be larger nearer the ends of the shoots. Each leaf is short petioled, oval to elliptic, tapered at both ends or sometimes narrowly rounded or indented at the base, and sharply toothed around the margin, with teeth at vein ends only slightly larger than intervening teeth. The secondary veins are nearly straight and parallel and some near the middle are distinctively forked. Undersurfaces are somewhat hairy, especially when the leaves are young.

The **twigs** are slender, slightly zigzagged, and reddish brown with inconspicuous lenticels. All **buds** are lateral, thus the end bud is a **pseudoterminal bud** with both a twig scar and a leaf scar at its base. The buds, except the end bud, are angled widely from the twig. They are greenish brown, plump, pointed, and have overlapping scales, each of which is striated along its length. **Leaf scars** are narrowly oval and each carries three vein scars. Many twigs carry preformed **male catkins** at their ends over winter. These are usually borne in threes, sideways, at an angle away from the direction in which the supporting shoot has grown, and each is 8—15 mm long.

Twig with ovoid pointed buds carried at wide angles

Extended female catkin at end of a new leafy shoot

In the spring, the male catkins elongate to 3—4 cm and hang down as their flowers emerge from below each bract. This happens as the new shoots and preformed leaves are expanding. At the ends of some of these new leafy shoots, preformed **female catkins**, that were hidden in the buds, extend. **Fruits** develop from the female flowers along these catkins. By fall, these become sharply hairy, yellow-brown sacs, 15—25 mm long, arranged in hanging catkins. Each sac contains a small, dark brown nut that contains a **seed**.

Mature fruiting catkins showing sacs, each containing a small nut

Ironwood **bark** is smooth, dark grey, with small horizontal flecks when young. When older, it is greyish brown and divided into narrow vertical strips that have loose, scaly surfaces. The scales peel away or are loose at both ends, and are easily rubbed off, revealing a reddish-brown color beneath.

Bark of stem, 25 cm in diameter

The bark of young ironwood trees is not distinct and may be confused with yellow birch (*Betula alleghaniensis* Britt.). In addition, their leaves are similar. Differences between the leaves of the two species occur in the degree to which features are displayed. The tendency for forking of the middle secondary veins occurs more strongly in ironwood and involves more of the veins (the forking is best seen on the undersides of the leaves). Differences between larger and smaller adjacent teeth around the margins tend to be greater in yellow birch than in ironwood, *i.e.*, yellow birch leaves are more conspicuously "doubly serrate." Neoformed leaves near the ends of the strongest shoots of yellow birch are copiously velvety hairy on both surfaces, leaves of ironwood are never like that. Note that mature preformed leaves of yellow birch (from short shoots or from the basal parts of long shoots) have no hairs on their surfaces, but those of ironwood have some hairs on undersurfaces. Ironwood leaves are usually thinner than those of yellow birch.

Notes

Ironwood, as the name implies, is one of the hardest, heaviest, and toughest of our native diffuse-porous woods. However, it is not much used because the trees are small and occur relatively infrequently. The wood makes good sleigh runners and tool handles.

Picea rubens Sarg.

Red spruce

Habitat

Red spruce occurs on well-drained sites in lowland and upland areas. It is a very shade-tolerant species that may be found in mixture with many species—for example, as an understorey species growing beneath aspens and birches, as a companion species with balsam fir, eastern hemlock, and eastern white pine, and as a lesser component with sugar maple and beech. It is the predominant spruce species in western and central New Brunswick.

Form

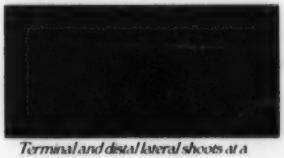
Red spruce grows to heights of up to 26 m and to stem diameters of up to 60 cm. The crown is conical when young. It becomes broadly conical in older trees and is made up of rather thinly foliated branches that are mostly horizontal and upturned at their ends. This gives a pagoda-like appearance to the crown which, in stand-grown situations, occupies no more than about one-third of the height of the tree.

Mature red spruce

Open seed cone after winter

Morphology

The **leaves** are needle like, 7–16 mm long, roundly four-sided, bluntly tipped, and shiny, yellowish green. Each is borne



Terminal and distal lateral shoots at a branch end

on a brownish **pulvinus, or leaf cushion**, that projects from the shoot. The leaves occur in a series of long spirals around the shoot and tend to lie somewhat forward, or appressed, along the shoot with those attached on the underside being bent upwards a little.

The **twig** surfaces are made up of longitudinally arranged, small, round-topped ridges, each of which supports near its outer end a leaf cushion with its leaf. The twig surfaces become pale orange brown by the end of the growing season. The round-topped ridges carry a few tiny steeple-shaped

Pollen cones at the pollen-shedding stage

hairs on their surfaces, and many more in the valleys between the ridges. The **terminal bud** is surrounded by small, forward-pointing leaves that tend to obscure it. The bud has shiny, reddish-brown outer scales that sometimes extend slightly. Smaller, ovoid, **lateral buds** may occur in axils of leaves farther back along the shoot.

Pollen cones and **seed cones** extend from their buds before the new shoots begin to grow. Pollen cones grow erect to lengths of 12–18 mm, shed their pollen into the air, and then shrivel and later drop from the tree. The young seed cones also grow erect at first, when their pinkish-purple scales are spread apart to channel pollen in to where the ovules are. Then the scales close up, or are pressed together as the cones grow, turn downwards, reach full size by mid-July, and mature. The ripe reddish-brown, 25- to 40-mm long, ovoid, pendant, cones spread their dry scales apart to release their seeds, starting in about mid-September.

Young seed cone open to receive pollen

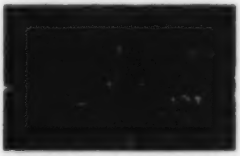
Bark of stem, 33 cm in diameter

The **bark** of young trees is pale reddish brown and loosely scaled, or shreddy. On older trees, the bark is broken into elongated reddish-brown to reddish-black scales with, ultimately, deep furrows. From a distance, the trunks of red spruce trees show up because they have a distinct purplish hue which, once recognized, is a valuable feature for identification.

Notes

Some people may have difficulty distinguishing the three spruce species native to New Brunswick. They each have distinct features.

White spruce (*Picea glauca* (Moench) Voss) can have a similar stature and crown breadth to red spruce, but its crown is usually bushier in appearance because its branches are more heavily foliated and do not tend to turn up much at their ends. The crown is also often spread farther down the stem. From a distance, the crown is bluish green, not yellowish green as is that of red spruce. At the shoot level, the bluish-green leaves are longer than those of red spruce and are spread outward around the shoot. Leaves are more pointed and, along the twig surfaces, the rounded ridges usually bear no hairs. The mature seed cones are more cylindrical than those of red spruce, and are softer to the touch, being less woody. The bark of white spruce is relatively smooth and grey until old age when it darkens and becomes more scaly.



Shoot surface showing its round surfaced ridges that carry the leaf cushions and straight-shaped hairs

Black spruce (*Picea mariana* (Mill.) B.S.P.) has a narrower crown than the other two spruces. The top of its crown is often densely tufted because it carries a mass of short branches and cones and, below the middle, branches tend to droop downwards in open conditions, sometimes to the ground. Like those of white spruce, its leaves are bluish green, but usually more distinctly whitish blue on their undersurfaces. They are of similar size to those of red spruce and may be somewhat appressed to the shoot or more spreading. The leaf cushions are attached to flat-surfaced ridges, so the surface of a black spruce shoot resembles more the staves of a barrel than the fingers on the back of a hand, as do those of red and white spruce. Both the flat surfaces and the indentations between them are covered with short hairs, many of which have tiny swollen glands at their ends, so they look like little straight pins; some are curled in various ways. Black spruce seed cones are darker, smaller, and more orbicular than those of red spruce. Most stay unopened on the trees for many years but some, especially on younger trees, do open somewhat during their first fall. The bark of black spruce is dark and scaly.

Twig-surface features and leaves offer the simplest and surest way to dinstinguish the three species. The ridge and hair features (which require a hand lens for proper viewing), and the leaf color and orientation, readily combine for positive identification. The best shoots to use are side shoots at the end of a branch, and the easiest viewing is of the undersurfaces of the shoots.

Red spruce and black spruce hybridize with each other when they grow in close proximity, and their offspring can cross back with either parent. As this sort of introgressive hybridization goes on over time, populations can arise in which individual trees may be of all shades of mixture of the two species. This has happened in the plateau area of central New Brunswick where the typically upland red spruce grow on well-drained soils close to the typically lowland black spruce on poorly drained soils. Because there is only a few meters' difference in elevation between the two types of sites, interbreeding has occurred and offspring have been able to establish on intermediate sites. Nevertheless, it is usually possible to identify hybrid individuals as "mostly black spruce" or "mostly red spruce." The problem, however, is that gradually the species are becoming less and less pure. This is more of a concern for red spruce than for black spruce because it has a much smaller range and, in New Brunswick, the ranges of the two species overlap entirely.

Red spruce is likely to suffer severe defoliation by spruce budworm. This will particularly be the case when it is growing in mixture with balsam fir, which suffers more. Red spruce/black spruce hybrids suffer less than do red spruce trees, so in spruce budworm-killed areas some hybrids may survive. This also serves to "dilute" the red spruce population.

Red spruce wood is pale brown or cream, relatively soft, and moderately strong. It is used as lumber for construction, in plywood, and as a source of wood pulp.

Pinus resinosa Ait.

Red pine

Also known as: Norway pine.

Pollen-shedding pollen cones clustered around the base of a new, relatively weak, elongating long shoot

Habitat

Red pine grows mostly on well-drained sandy or gravelly soils. It may occur in pure stands or in mixture with eastern white pine and several other species on more moist soils, or with jack pine on drier soils. It is shade intolerant, so does not establish beneath much cover.

Form

Red pine grows to heights of up to 25 m and to stem diameters of up to 70 cm. It has a neatly conical crown through its younger stages, and later forms a short, broad, oval crown. With increasing age, the crown tends to become flat-topped and irregular.

Crown of a young tree

Morphology

Like all pines, red pine produces two kinds of shoots. **Short shoots, or microshoots**, grow out once and carry the leaves (except on a first- or second-year seedling). **Long shoots** carry the microshoots, produce buds, and form the branches. Thus, along each new long shoot, beyond a small section that remains bare, there are many microshoots borne in a series of long spirals and, at the end of the long shoot, a whorl of **lateral long-shoot buds**, and a **terminal long-shoot bud**. Each microshoot has a sheath of **bud scales** extending about 1 cm out along the bases of two needle-like leaves. The leaves are dark green, 8–15 cm long, sharp pointed, half round in cross section, and finely and sharply toothed along the two margins.

The **buds** are chestnut brown, pointed, and resinous with loosely overlapping hairy scales. The **twigs** or **long shoots** are shiny, orange to reddish brown, and somewhat grooved. There are small raised scars scattered along the basal bare portion of the long shoot and at the base of each microshoot where there was once a bud scale.

Closed young seed cones in their first summer around a developing terminal long-shoot bud

Pollen cones occur along the lower parts of many weaker long shoots in place of microshoots. These emerge, extend to lengths of up to 25 mm, and shed pollen as long-shoot elongation takes place. They then shrivel and fall. **Seed cones** occur in place of new lateral long-shoot buds at the tips of more vigorous elongating long shoots. They are purple at first, when their scales are spread apart to permit pollen to access the ovules. The scales then close together and the cones grow in their first year to small brown structures 8–10 mm in diameter. The next season, the seed cones become green and grow to full size when, as they ripen, they become brown. They may open to release seeds in the second fall, or in the following early spring. The mature seed cones are 4–6 cm long, ovoid when closed, and nearly orbicular when open, and have thickened brown scales with paler smooth ends.

Developing seed cone in its second year

The **bark** is reddish or pinkish brown, and loosely scaly when young. It is thick and deeply furrowed between broad, flat, pale reddish-brown, scaly plates when old.

Bark of stem, 48 cm in diameter

Notes

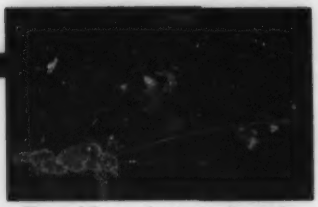
Red pine is easily distinguished from the other native pines by leaf length and number of leaves per microshoot. Jack pine also has two leaves per microshoot, but they are rarely more than 3 cm long. Eastern white pine has leaves 4–6 cm long, but there are five per microshoot. Red pine might be confused with the introduced Scots pine (*Pinus sylvestris* L.) because the young bark is somewhat similarly colored, but the leaves of Scots pine are much shorter and often bluish green. The introduced Austrian pine (*Pinus nigra* Arn.) is less easy to distinguish because its leaves are of similar length to those of red pine, and it also has two leaves per microshoot. However, its leaves tend to be less brittle than those of red pine, so they don't break as cleanly when bent. Its buds are pale brown and usually whitened by resin, and its twig surfaces are yellowish green to brown and thus quite different from red pine.

Open mature seed cone

Red pine is used extensively for poles and piling. The wood is relatively hard and can be used for structural timbers. Red pine is often planted as an ornamental.

Prunus nigra Ait.

Canada plum



Flowers fully open showing their five petals

Habitat

Canada plum is uncommon, but occurs as a scattered small tree, or sometimes in patches, in open areas in river valleys on alluvial soil, or over limestone. As such soils have often been developed for agriculture, the species may be found in pastures, in hedgerows, or along fence lines.

Form

Canada plum can grow to heights of up to 9 m, and to stem diameters of up to 25 cm, but is usually smaller. It is a straggling tree, often developing in clumps, and commonly having upward growing, crooked branches originating low down on the stem. The crown is irregularly rounded and usually flat topped.

Small tree in understorey

Morphology

The thin, fragile, deciduous, simple **leaves** are borne alternately. Each leaf is 5–12 cm long, obovate to oval (broadest above or at the middle), rounded, indented, or broadly wedge shaped at the base, narrowing abruptly to a long, slender-pointed tip, and neatly double toothed around the margin, with each tooth rounded and often gland tipped. The upper surfaces are dull, dark green, and the lower surfaces paler with a prominent main vein that joins a short, stout petiole (leaf stalk) which carries a dark gland on each side near the base of the lamina (leaf blade).

The **twigs** are slender, reddish dark brown, and marked with small, beige, horizontally extended lenticels. Many short, side shoots each end in a sharp **thorn**. The **buds** (which are all lateral) are greyish brown, ovoid, up to 8 mm long, often appressed to the twig, with overlapping scales that tend to have thin, pale, frayed tips. Some buds on shoots below thorns are like tiny bulges.

Twig and thorns

The showy **flowers** are borne on stems (pedicels) 15–30 mm long, in clusters of two to four, from buds on the previous year's twigs, including side twigs that end in thorns. Each flower is 15–25 mm across and has five white petals that change to pale pink as they age and begin to shrivel. Blooming

occurs just before or as the new leaves start to extend on shoots from other buds. **Fruits** (plums) develop from some of the flowers. The ripe, reddish-yellow **plums** are 25–30 mm long. However, many fruits fail to develop because they become infected by a fungus, and shrivel to brownish, crinkled, oval masses hanging from their stalks. Many of these remain on the twigs over winter.

Black, shrivelled, diseased fruits held on the tree over winter

The young **bark** is shiny, reddish dark brown to black with horizontally elongated beige to grey lenticels. Older bark is first separated by vertical splits with edges curled back, but eventually becomes ruggedly scaly.

Bark of young stem, 2.5 cm in diameter

Notes

The plum fruit is somewhat sour to the taste but is excellent when cooked or in jam. Some cultivars (varieties cultivated by horticulturalists) have been developed and may be available for ornamental planting because of their attractive but short-lived flowers or for fruit production.

The shriveled fruit or "plum pockets" are caused by a fungal disease, *Taphrina* ssp. The fruit is distorted up to ten times its normal size and does not produce a seed. This hampers Canada plum regeneration and limits the use of the fruit for human consumption.

Canada plum, like all members of the genus *Prunus*, also suffers from black knot, a fungal disease of twigs and branches caused by *Apiosporina morbosa* (sometimes *Dibotryon morbosum* in older books). It causes large, irregular, black swellings which can girdle and kill small branches in a few seasons, affecting overall vigor. If the main stem is infected, the entire tree may be killed.

Members of the genus *Prunus* can be distinguished by their fruit or by injuring the bark or foliage and smelling the pungent odor of almonds or cyanide. Children have been poisoned by eating seeds or chewing twigs. Tea made from the leaves of various cherries and plums is also poisonous.

Bark of stem, 8 cm in diameter

Prunus serotina Ehrh.

Black cherry

Habitat

Black cherry occurs mostly on lower slopes where soils are rich and well drained, or on alluvial soils in river valleys. It is commonly mixed with species such as white ash, basswood, yellow birch, sugar maple, beech, red oak, and white spruce. It prefers more open conditions because it is shade intolerant.

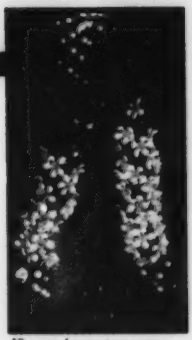
Form

Black cherry is a tree that can grow to heights of up to 23 m, and to stem diameters of up to 60 cm. Its stems are frequently somewhat sinuous. The crowns are narrow, oblong or rounded, and made up of slender arching branches with drooping tips.

Tree at the blooming stage

Morphology

The **leaves** are deciduous, simple, short stalked, and borne alternately (in a single spiral) along the shoots. Each leaf is 5–18 cm long, narrowly oval to lanceolate, and tapered to a sharp point. The margins have many, fine, forwardly pointing and inwardly curving teeth. The underside of each leaf is distinctive in that there are mats of white to rusty-brown hair along either side of the basal part of the midvein.



Flowers borne in racemes

The **twigs** are reddish brown with many reddish-brown ovoid but blunt-tipped **lateral buds** with dark-edged overlapping bud scales, and a similar **terminal bud**. Sometimes one or more lateral buds may be quite close to the terminal one. The twigs have a bitter-almond taste.

The five-petalled, white **flowers** occur in hanging clusters of many short-stalked flowers borne along a central stem (in racemes) at the ends of new, leafy shoots. Some of the flowers in each cluster go on to form fruits. The **fruits**, which are small, bitter cherries, 8–12 mm across, change from green through pinkish orange to red, and then to black as they ripen.

Developing fruits

The **bark** is smooth and dark reddish brown to black with greyish horizontal flecks when young. As the bark ages it breaks into irregularly rectangular, dark greyish, horizontally marked plates that tend to curve outwards at their upper and lower ends.

Bark of stem, 22 cm in diameter

Notes

Black cherry wood is hard, semi ring porous, strong, attractively grained, and light to dark reddish brown. It is valued for furniture and specialty products.

The fruits are excellent for jams and jellies, and extracts are used as flavoring in candies, lozenges, and soft drinks.

Black cherry, especially when it bears flowers or fruits, may be confused with choke cherry (*Prunus virginiana* L.) because its flowers are also borne in racemes, and it can bear similar black fruits (also red, or yellow fruits). However, choke cherry fruits have only tiny remnants of the flower parts at their bases, whereas those of black cherry have far more distinct and larger flower remnants. Choke cherry leaves are also smaller, broader for their size, broader above the middle, and more finely and more sharply toothed around the margins. They are hairless along the midveins below. Choke cherry is a multistemmed shrub species, and only rarely a small tree. It emits a much stronger bitter-almond odor when its twigs are bruised or broken.

Ripening fruit

Quercus macrocarpa Michx.

Bur oak

Also known as: Blue oak, mossycup oak.

Leaf with typical pinnate lobing

Habitat

Bur oak is rare in New Brunswick. It occurs only in the lower St. John River valley where it occasionally grows with other hardwood species on rich bottomland sites.

Form

Bur oak is a tree that can grow up to 18 m in height with stem diameters up to 50 cm. The crown is broadly rounded and open. Upper branches are angled obliquely upward but middle and lower branches are mostly horizontal and zigzagged.

Mature tree

Morphology

The **leaves** are deciduous, simple, and alternately arranged. They are 10–20 cm long, obovate, and pinnately lobed, usually with a broadly expanded end part with rounded teeth separated from the lower, tapered, slightly round-lobed part by two or three deep, rounded sinuses, and rounded lobes; sometimes, leaves are irregularly round lobed throughout. The upper surfaces are shiny and deep bluish green and the lower surfaces are pale, dull, and slightly hairy.

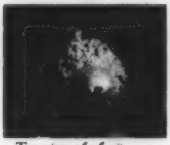
The **twigs** are stout, yellowish brown, slightly hairy, and often somewhat ridged. The **lateral buds** are conical to ovoid, blunt tipped, brown, and hairy. They are borne on slightly projecting portions of twig surface and tend to be appressed to the twig above. The buds near the twig ends are close together, sometimes abutting the **terminal bud**. Among these clustered buds are short, narrow-pointed, arching scales. The **pith** of a twig, when viewed in cross section, has five points.

Twig showing leaf scars raised from the twig surface

Male catkins at the base of a new shoot and female flowers in the axil of the second new leaf along the shoot

Male flowers are borne scattered along limp, hanging catkins, up to 8 cm long, that emerge rapidly at the bases of newly expanding shoots. Once pollen is shed, the male catkins are shed. **Female flowers** are borne in small clusters on short stems in axils of new leaves farther along vigorous new shoots. The **fruits**, which are a kind of nut that is called an **acorn**, develop quickly from the female flowers. Each developing acorn is almost covered by a greyish-green acorn cup formed of a mass of closely packed scales with extended tips that form a bur-like structure with a distinct fringe around the portion of the acorn that is exposed. The originally green acorn gradually changes to yellowish brown as it matures in the fall.

Side view of a fruit – the acorn is mostly covered by the bur-like acorn cup



Top view of a fruit

The **bark** is smooth and light ashy grey when young. When older it is deeply dark grey, furrowed with light-grey, flattened ridge tops.

Bark of stem, 76 cm in diameter

Notes

Bur oak is in the "white oak" group of oaks that have round-lobed leaves and acorns that develop to maturity in one season. The "red oak" group, in contrast, have pointed-lobed leaves with bristle tips to the lobes and acorns that take two seasons to mature. Thus, a red oak commonly has acorns of two sizes in the fall, 1 season old (small ones) and 2 seasons old (mature ones).

Bur oak wood is ring porous, hard, and strong, and can be used for furniture, interior trim, boat building, and, because it is of the white-oak group, barrels for storing liquid (woods of the red-oak group cannot be used to store liquids).

Bur oak withstands city environments well, so is useful for streetside plantings and other ornamental uses.

Salix nigra Marsh.

Black willow

Female catkins with flowers ready to receive pollen

Habitat

Black willow occurs naturally in New Brunswick only in the lower St. John River valley. Its most northerly occurrence is thought to be Burtt's Corner on the Keswick River. It grows mostly in river-side areas and thus on low-lying, moist soils or swampy areas, and may be mixed with red and silver maple, white elm, and red ash. It is very shade intolerant, so is found only in relatively open conditions.

Form

Black willow is usually a small tree that grows up to 13 m in height and up to 50 cm in stem diameter, but in some parts of its large range, it may grow up to 20 m tall. The stems are often forked, and the crowns are broad and irregularly rounded. The wide-spreading branches tend to be brittle, so breakage is common.

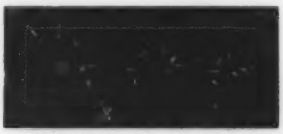
Tree in early spring

Morphology

The **leaves** are simple and are borne fairly close together but alternately (in a single spiral) along the shoots. Each is 5–14 cm long, narrowly lanceolate and tapered to a long-pointed tip which tends to bend sideways. The leaf margins are finely and evenly toothed. Each leaf has a short petiole, at the base of which are two green, ear-like, toothed, persistent, **stipules**.

The buds, which are all **lateral buds**, are small, yellowish brown, shiny, pointed to somewhat flattened and round tipped, and each has a single cap-like scale. They are borne along thin yellowish-brown to reddish- or purplish-brown, shiny **twigs** that are slightly ridged below each tiny leaf scar. The **pseudoterminal bud** at the twig's tip may be bent over the tiny scar formed when the shoot tip was lost.

The **flowers** are borne in catkins, 2–7 cm long, that tend to be more or less erect, at the ends of new short leafy shoots during the blooming period. The trees are either male or female, so it is only on **female trees** that the catkins stay on the trees as the fruits develop from the flowers. The **fruits**, which are green,



Fruits (capsules) developing along a fruiting catkin, note the leaves below the base of the catkins

elongated, pear-shaped capsules, split open into two curled-back halves and shed their **seeds** in white, cottony masses in early summer.

The **bark** is yellowish brown and slightly ridged when young. When old, it is dark brown or reddish brown to black with thick interlacing, flaky, flat-topped ridges, and deep furrows.

Bark of stem, 15 cm in diameter

Notes

Black willow wood is diffuse porous, light in weight and color, soft and weak, but tends not to warp, check or splinter. Where reasonably plentiful, it is used for packing cases, barn floors, toys, and polo balls.

Black willow can be confused with crack willow (*Salix fragilis* L.), an introduced and naturalized tree species. The leaves of each are similar in shape, but those of crack willow have less uniform toothing, and are whitish rather than pale green on their undersides. They also lack persistent stipules and, in the spring, when stipules are still present, they are small and insignificant. The buds of crack willow tend to be gummy, narrow, and sharp pointed, and they are borne on yellowish-green to dark red twigs. The bark of crack willow is grey with narrow ridges.

Taxus canadensis Marsh.

Canada yew

Also known as: ground hemlock.

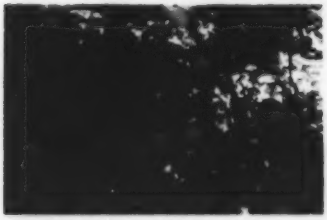
Undersides of shoots in early spring

Habitat

Canada yew (or ground-hemlock as it is often called) occurs beneath stands of conifers or mixed conifers and hardwoods in moist situations, especially in richer soils on slopes of river or stream valleys, and on rocky banks.

Form

Canada yew is an evergreen shrub that typically occurs in large clumps or colonies where it has a straggling and low,



Shrub in a clump in the understorey

spreading form. It rarely grows more than 1.3 m tall, but its branches may be more than 2 m long. The interlacing branches curve upwards towards their ends and frequently produce roots along their lower surfaces where these touch the forest floor.

Morphology

The evergreen **leaves** are 8–20 mm long, needle like, but flat, with parallel, smooth margins, and are arranged in multiple spirals along the shoots. Each leaf is sharp pointed and tapered at the base to a short narrow stalk or petiole that is twisted so that the leaf is splayed outwards with its dark green, shiny, upper surface more or less horizontal. The undersurface is uniformly yellowish green (but somewhat whitish bands of stomata may show up with magnification), and the petiole is seated on a slight leaf cushion that extends as a green ridge a short way down the twig surface. The foliage frequently takes on a purplish hue over winter.

The **twigs** are green, becoming greenish brown or reddish brown as they age. **Terminal buds** are small and have overlapping green scales. Some **lateral buds** are similar, but there are few such buds, and some branching is neoformed, occurring in leaf axils as growth proceeds, and without prior production of scaly buds. Other **lateral buds** are more noticeable because they protrude as bulbous, yellowish-green, scaly structures from leaf axils

Tip of ovule protruding from its bud and exuding a pollination drop

on lower shoot surfaces. The larger and more numerous of these are pollen-cone buds, and the smaller and scarcer ones are ovule buds.

Pollen cones emerge from their buds in early spring. Each pollen cone consists of several pollen sacs carried out from the bud scales on a central axis. After the pollen is shed into the air, the pollen cones wither and fall. From each **ovule bud**, the tip of a single ovule is extended, and from it, a drop of fluid is exuded. Pollen that lands on the drop of fluid is drawn into the ovule to effect subsequent fertilization. A fertilized ovule develops into a **seed**, but around the seed a fleshy, berry-like structure called an **aril**, develops and, by early fall, becomes a red cup-like cover, 5–8 mm across, deep within which the tip of the brown seed can be seen. Most plants bear both pollen cones and ovules and seeds, but some may bear pollen cones only, and others ovules and seeds only.

Pollen cones about to shed pollen

A ripe aril showing the tip of its single seed

The **bark** of the largest stems is dark reddish brown. As indicated, older branches are often embedded in the forest floor.

Notes

Canada yew is readily distinguished from the other native evergreen, coniferous shrubs, common juniper (*Juniperus communis* L.) and creeping juniper (*Juniperus horizontalis* Moench), because it is the only one with flat, needle-shaped, stalked leaves. It is more likely to be thought of as clumps of balsam fir (*Abies balsamea* (L.) Mill.) or eastern hemlock (*Tsuga canadensis* (L.) Carr.) regeneration (hence the common name ground-hemlock), but the leaves of each of these other species have clearly defined whitish bands of stomata on either side of a distinct midrib on their undersurfaces, and the plants generally have upward, not spreading, growth.

The leaves of Canada yew are poisonous to horses and cattle, but apparently they are not poisonous to deer and moose, which may browse them. The seeds are poisonous, but birds eat the fleshy aril and excrete the hard-coated seeds, spreading the plant to new areas.

A natural substance, paclitaxel, can be extracted from the bark, twigs, leaves, and roots of Canada yew. Paclitaxel, which has been given the simpler name Taxol®, has been found to be an effective anti-cancer drug. This has resulted in substantial recent interest in the species.

Thuya occidentalis L.

Eastern white-cedar

Habitat

Eastern white-cedar is a shade-tolerant species that grows on a variety of sites. It may occur in pure stands in swamps or over limestone on better-drained sites, but it also occurs in association with balsam fir, eastern hemlock, spruces, red maple, and yellow birch on moist, moderately drained sites.

Developing seed cones

Form

Eastern white-cedar grows to heights of up to 16 m and to stem diameters of up to 45 cm. In a stand, the crown is relatively open and narrowly conical, but in more open conditions, the crown is dense, conical to columnar, and often long. The stem is noticeably tapered and sometimes irregular in cross section. In poorer conditions, where growth is stunted, several curved and twisted stems are common.

Mature tree

Morphology

The tiny yellowish-green **leaves** are of two scale-like forms borne in pairs, with each pair alternating in direction from the previous pair. Leaves on the upper and lower surfaces of the shoots are shield shaped and each has a small gland at its center. They overlap the base of the next pair of side leaves, which are keel shaped.

Together, the paired leaves cover the small shoots, which branch often to form **flattened sprays**. Older sprays of foliated shoots senesce, turn yellowish then orange brown by October, and fall from the trees. The stronger shoots, from which the sprays branch, tend to bear leaves in pairs that are more pointed. As they age, these turn first yellowish, then pale brown, and form the "bark" of the **twigs** or branches until they split off exposing the true dark reddish-brown bark developing beneath them.

Preformed overwintering pollen cones at tips of shoots (top); end of spray of shoots with many scale-like leaves (bottom)

As indicated, there is frequent branching among the shoots, but this is accomplished from axils of leaves without the formation of scaly buds. Growth, and develop-

ment of new pairs of leaves at shoot tips simply stops at the end of the growing season. The apical growing points responsible (apical meristems) are protected over winter by their latest tiny products, the last pairs of leaves. The next spring, growth simply picks up from where it had stopped. The latest leaves of the previous season grow a little, and new leaves and shoots start to form. Because there are no marks left on the shoots (no bud scars), it is not possible to determine how much of the shoot system grew in a given year. Eastern white-cedar, does not produce buds, so all branching is neoformed (a type of branching known as sylleptic branching).

Open, mature seed cone

Upper crown of a young tree bearing developing seed cones

At times, darkened tips to some of the tiny shoots look as though they may be buds, but these are either preformed **seed cones** or preformed **pollen cones**. Very early in the spring, these extend either to expose ovule tips for pollination or to shed pollen. The pollen cones then shrivel up and remain as deadened tips on the shoots for many months. The seed cones continue growing, become green upright structures through the summer, and then change through greenish yellow to orange brown by October when the opposite scales of the small (7–15 mm long), still upright cones spread apart a little to permit seed to be shed. The **seeds** are not winged at one end as are those of most other conifer trees, but have flat lateral wings spread out on either side of the elongated seed.

The **bark** is reddish brown, and shiny when young, and quickly becomes fibrous. With increasing age, it becomes separated into narrow, flat, greyish-brown, longitudinal strips. Sometimes the strips spiral slightly up the stem.

Bark of stem, 25 cm in diameter

Notes

Eastern white-cedar is a member of the cypress family (Cupressaceae), not the pine family (Pinaceae), as are our other coniferous trees. The name "cedar" is not really appropriate, as that is the name for trees of the *Cedrus* genus (in the Pinaceae), like "cedar of Lebanon" (*Cedrus libani* A. Rich.). Eastern white-cedar has many other common names: among these, eastern thuja or eastern arbor-vitae would be the preferred names.

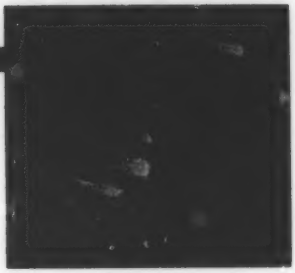
Because the heartwood of eastern white-cedar is extremely durable, tree stems are used for posts, poles, and fences. The wood is also used for fence boards, decks, shingles, siding, and boat building and, because of its aroma and moth-deterring properties, for cedar chests and closets.

The foliage of eastern white-cedar is a favorite winter food for deer, so overwintering deer yards are frequently found in or near areas where the species is common.

Tilia americana L.

American basswood

Also known as: American linden.



Leaf showing the cordate (roundly indented) base and typical venation

Habitat

In New Brunswick, basswood occurs only in the west and southwest, but principally in the St. John River valley. It grows as a scattered tree on rich, moist sites in mixture with many other species, mostly hardwoods. It tolerates shade.

Form

Basswood can grow to heights of up to 27 m and to stem diameters of up to 75 cm. The stems are usually straight and distinct into the upper parts of the even, rounded, rather small crowns. The branches tend to arch outwards with upturned ends.

Mature tree

Morphology

The **leaves** are deciduous, simple, and alternately arranged. They are 12–15 cm long and almost as wide, and have petioles, which are often angled away from, and one-third to half as long as, the laminae. The leaves are broadly ovate, tapered to a pointed tip and cordate (roundly indented) at the base, which is often unequal from one side to the other. The leaf margins are coarsely toothed, and there are tufts of hairs on the under surfaces where veins meet.

The **twigs** are moderately stout, green to purplish brown or yellowish brown, and somewhat zigzagged. The **buds** are reddish, plump, and lopsided with two or three overlapping scales visible, and are offset from their leaf scars below. The end bud is **pseudo terminal**, and is usually angled over the twig end away from its leaf scar. **Leaf scars** are semi-oval and have five to ten tiny vein scars.

Twig with pseudoterminal and protruding lateral buds

The **flowers** bloom in midsummer after the leaves have fully expanded. They are borne in small, branched, hanging clusters that are carried by a single stem that grows from the midrib of a linear-lanceolate pale yellow-green bract that is about 7 cm long. From each flower in the cluster, a hard **nut-like fruit** about 6 mm in diameter, can develop, and can contain a single **seed**. When the fruits are ripe in early fall, the whole bracted structure may be shed and whirl to the ground. This starts to happen at about the time of leaf fall, but some fruits may be held on the trees over winter.

Flower buds borne in a cluster from a pale green bract

Fruits borne clustered below a pale brown mature bract

The **bark** is greyish green when young, and greyish brown with long, narrow, fairly smooth-surfaced ridges when old.

Bark of a stem, 21 cm in diameter

Bark of a stem, 35 cm in diameter

Notes

Basswood has diffuse-porous wood, light in both weight and color, soft, and uniform. These features make it valuable for hand carving, modeling, turnery, interior trim, and piano keys. The flowers are noticeably fragrant, and basswood honey has a distinctive taste. Rope can be made from fibers in the bark. This fibrous feature is the reason that squirrels strip bark from thin branches and take it to line their drays.

Tsuga canadensis (L.) Carr.

Eastern hemlock

Developing seed cones at end of shoots, in mid-summer

Habitat

Eastern hemlock sometimes occurs on well-drained sites in pure stands or groves, but more commonly is mixed with red spruce and balsam fir, and sometimes sugar maple, beech, yellow birch and eastern white pine. It tolerates shade well, so it has the ability to grow slowly in dense shade for decades. Trees may last for well over 400 years.

Form

When young, the dense crowns of eastern hemlock can be gracefully conical

Leading shoot of a tree showing bent-over character and sylleptic branches along it

with slender flexible branches that turn down at their ends, but sometimes crowns are more bushy with many stems vying for leader status. Middle-aged trees have irregularly conical to rounded crowns, and old trees, ragged, irregular, rounded, crowns with several large branches. Leading shoots are always bent over to a greater or lesser extent. Trees may grow to heights of up to 30 m and to stem diameters of up to 100 cm. The stems are noticeably tapered on younger trees, but can become massively columnar on older trees.

Morphology

The **leaves** are evergreen, needle like, 5–15 mm long, flat, dark green above, paler green with two whitish bands where stomata occur below, blunt pointed, with slightly and finely toothed margins, and rounded bases that merge into short petioles. Each leaf is borne on a tiny leaf cushion which arises from a flattened ridge that runs down the shoot a little. Although all leaves are borne in spirals around the shoot, those on its upper surface are shortest, and the ones borne below, that spread out sideways, are the longest.

Along each new shoot of more than about 6 cm long, there are small side shoots, without bud scales at their bases, in axils of leaves. On the shorter new shoots, these **sylleptic side shoots** may comprise only a short stem, a few small leaves, and a terminal bud, but on longer new shoots, some of the sylleptic

Pollen cones in axils of leaves

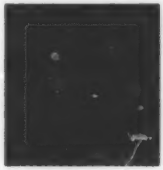
shoots in the central part can be up to 10 cm long and carry leaves all along their lengths. Such shoots add substantially to the density of the crowns. Because sylleptic shoots occupy many positions where, otherwise, lateral buds would have occurred, there are relatively few true lateral buds. Most buds occur at the ends of shoots. The **buds** are small, conical to round, and greenish brown. They develop late in the season and carry only a small amount of preformed content. When the new shoots grow out, much of their lengths are neoformed.

Pollen cones are borne along the undersides of weaker shoots, in axils of leaves.

Seed cone open to release seeds

Seed cones hang, throughout their development, at the tips of shoots of moderate vigor, and are 12–20 mm long when they open to release seeds, starting in late October.

The **bark** is dark brown and scaly when young. It is thick and deeply furrowed, with dark greyish-brown, flat-topped, slightly scaly ridges when old. If pieces of bark are broken off, purple flecking will show in the broken surfaces.



Bark of stem, 30 cm in diameter

Bark of stem, 90 cm in diameter

Notes

The wood of eastern hemlock is liable to have splits in it, even when still standing in the tree. The splits can occur in the radial direction and around the annual rings. This tendency for splitting limits the wood's usefulness, except as large-dimension lumber in general construction.

Because the bark has a high tannin content, eastern hemlock trees used to be cut for their bark. The tannin was used in the tanning of hides for leather.

Ulmus americana (L.) Carr.

American elm

Also known as: white elm.

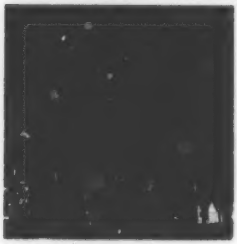
Leaf showing the strong parallel secondary veins that end in a large forward-pointing tooth that has secondary toothing along its outer edge

Habitat

White elm occurs on lowlands and bottomlands, often where spring flooding occurs. It occurs in river valleys and on moist soils along streams, but grows best where soils are rich and reasonably well drained.

Form

White elm has a distinctive, vase-shaped form, in that the stout stem often divides into several large upwardly and outwardly arching branches that form a wide-spreading rounded, umbrella-like crown. The trees may grow to heights of over 30 m and stem diameters may be up to 120 cm. Larger stems are usually buttressed at the base.



Mature trees

Morphology

The **leaves** are deciduous, simple and arranged alternately along the shoots. Each is 6–5 cm long, elliptic-oblong to obovate, often inequilateral, especially near the base, and drawn in to a short point at the tip. The margins are coarsely doubly to triply toothed, with each large tooth, reached by a nearly straight secondary vein, hooked forward. The upper leaf surface may be rough to the touch, because of short, stiff, forwardly pointed bristles, and the lower surface may be somewhat hairy.

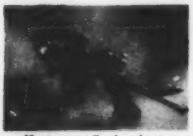
The greyish-brown **twigs** are slightly hairy and often zigzagged. The end bud, a **pseudoterminal bud**, is usually angled over the tip of the twig, and **lateral buds** tend to be appressed to the twig. The reddish-brown **buds** are ovoid and round tipped with overlapping scales that have hairy and darker margins. The buds are often somewhat offset from the small, oval V-shaped **leaf scars** which each have three vein scars.

Twigs showing lateral and pseudoterminal buds

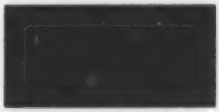
In spring, before the leaves expand, the crowns of older trees thicken with clusters of pale yellowish **flowers**.

Fruits ripen and start to fall as leaves expand

From these, **fruits** develop quickly, ripen, and fall by the time that the leaves have nearly expanded to full size. Each **fruit** has a flat, nearly circular wing with a hairy fringe, attached around the lower central seed pocket that contains one seed.



Fruits rapidly developing as shoot buds near the bursting stage



Fruits showing their fringed edges and splits in the wings at their ends

The **bark** is smooth and grey when young, but quite quickly becomes greyish brown with obliquely intersecting flat ridges. In old age, the broad ridge tops become ashy grey and scaly. Broken surfaces of outer bark frequently show alternating dark brown and orange-brown bands.

Bark of stem, 28 cm in diameter

Notes

The yellowish-brown, ring-porous, hard wood of white elm has an attractive grain, making it suitable for panelling, furniture, and veneer. It is also used for caskets and in boat building.

White elm was formerly a common tree in lowland areas and in towns and cities where it was often planted as a shade tree. Dutch elm disease, an introduced fungal disease that is spread by elm bark beetles, arrived in New Brunswick at Woodstock in 1957. In the years that followed, the disease spread rapidly and intensified along the St. John River Valley. It was common for tree losses to exceed 90% in only 8 years.

Sanitation, the practice of removing any dead or decadent trees and careful pruning of the healthy trees, eliminated the breeding material for the elm bark beetles and controlled the spread of Dutch elm disease. This has been demonstrated in the City of Fredericton, with its large population of century-old elms, which has had a consistent sanitation program since before the disease arrived in 1961. The City has retained over one half of its elms even though Dutch elm disease has been present for nearly 40 years.

Elm is still regenerating along streams and rivers in New Brunswick. Unfortunately, as soon as an elm reaches the sapling stage, elm bark beetles move in carrying Dutch elm disease, and the young tree is infected and dies.

Viburnum edule (Michx.) Raf.

Squashberry viburnum

Ripe fruits

Habitat

Squashberry viburnum, or simply, squashberry, occurs in damp, rich, coniferous or mixed woods, along brooks, in wet thickets, and in forest edges, in the northern half of New Brunswick.

Form

Squashberry is a straggling to somewhat erect shrub about 1 m tall when in an understorey, and up to 2 m tall in more open areas.

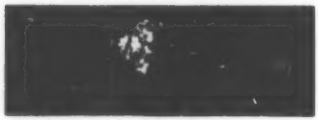
A shrub of the understorey

Morphology

The **leaves** are deciduous, simple, and borne oppositely in pairs at successive nodes. The leaves of lower pairs on longer shoots, and those on short shoots usually have three lobes, all well above the middle of the leaf and separated by shallow, more or less rounded clefts, or sometimes by deeper, wide, V-shaped clefts. The leaves of upper pairs on longer shoots are often unlobed, or only slightly lobed. All leaves are 4–8 cm long, sharply but irregularly toothed around the margin with stalked glands where the margin meets the petiole (which is 8–40 mm long), roundish to oval, sharp pointed at the tip, and broadly rounded to wedge shaped at the base. The leaves are dark green and smooth above and paler beneath where some hairs occur, especially along the veins and in vein axils.

The **twigs** are shiny, purplish or reddish brown to greyish brown, and often marked by longitudinal ridges, and a few pale lenticels. The **buds** are usually dark red and have two scales that meet in valve-like manner along their edges. A terminal bud is usually present.

The small, milky-white **flowers** are borne in loose, few-flowered, branched clusters at the tips of new, lateral, short shoots each bearing one pair of leaves. Usually, the opposing short shoot also bears a cluster of flowers. These shoots arise from a pair of lateral buds on a shoot of the previous year. **Fruits** develop from some of the flowers in a cluster. They ripen to orange-red, berry-like drupes, 6–10 mm across. Each fruit contains a single flat, ovate stone, or pit, that contains a **seed**.



Clustered flowers in axils of leaves

The **bark** on young stems is reddish brown. Older bark is ashy grey to brown, and may be wrinkled.

Notes

Squashberry might sometimes be confused with young highbush cranberry (*Viburnum trilobum* Marsh.) because some of the leaves may be superficially similar, and the buds are similar. However, the lobing is much more prominent in leaves of highbush cranberry, and all of its leaves are lobed. Also, its leaves carry glands near the upper end of the petioles, not on the lower margins of the laminae. Squashberry fruits are borne in much smaller clusters than are those of highbush cranberry.

The fleshy fruits are taken and ingested by animals and birds. This serves as a means of seed dispersal; the seeds are passed out, still in the stones, in the faeces.

The name "*edule*" means edible, probably implying that the fruits of this species are more palatable than are those of other viburnum species. An excellent jelly may be made from the fruits, especially after the first frost. However, gathering enough fruit may be a problem.